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AGRICULTURAL TEACHERS' SERIES

APRIL, 1938

NORTH CAROLINA STATE COLLEGE
OF
AGRICULTURE AND ENGINEERING
OF
THE UNIVERSITY OF NORTH CAROLINA

CROPS JUDGING HELPS

BULLETIN No. 1
DEPARTMENT OF EDUCATION
STATE COLLEGE STATION
RALEIGH, N. C.

FOREWORD

The Department of Education began preparation and distribution of special helps to teachers of agriculture in July, 1935. Since that time twenty-two circulars have been prepared and distributed to these teachers in mimeograph form. The demand for "Crops Judging Helps" has been so great that it is more economical to print the fourth run. This bulletin, No. 11 in the mimeograph series, is numbered 1 to start the Agriculture Teachers' Series in printed form.

Many teachers of vocational agriculture in the State have expressed a desire for crop judging information for use in training their students to identify quality seed produced in North Carolina. Because of this interest, an attempt has been made to compile brief descriptions of the principal varieties of crops certified by the North Carolina Crop Improvement Association, Inc., to date. Description of certain diseases and weeds affecting the growth of these crops are also compiled in the bulletin. Descriptions of approximately 100 varieties of crops seeds, diseases, and weeds are included.

The material in this bulletin was compiled by J. K. Coggin, Associate Professor of Education, in collaboration with W. H. Darst, Professor of Agronomy; J. B. Cotner, Professor of Plant Breeding; R. F. Poole, Professor of Plant Pathology; L. E. Cook, Professor of Education; and L. O. Armstrong, Associate Professor of Education, all of the North Carolina State College. Special attention is called to Professor Darst's description of the ten leading corn varieties grown in North Carolina. This is probably the first attempt of anyone to distinguish these varieties one from another. The paragraphs giving the "distinguishing characteristics" of the plants and seeds were prepared by Professor Darst.

T. E. BROWNE,
Director Department of Education.

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FIELD CROPS CONTESTS

OBJECTIVE: *To give students in agriculture practice in the selection of good seeds.*

It is important for any student in agriculture to have a knowledge of good quality in crop seeds. This involves not only a study of conditions affecting seed, but also a study of the diseases of crops and the noxious and troublesome weeds in seeds. The effect of insect and rodent damage must also be considered.

It is important that the student know and recognize crops and varieties of outstanding merit. He should know something of the breeding, climatic and soil adaptation of leading varieties.

To encourage this study the North Carolina Crop Improvement Association conducts a crops judging and seed identification contest for students of vocational agriculture during its mid-winter conference and seed exposition. Preliminary community, county, and district judging contests are also held preparatory to the annual crops contest sponsored by the North Carolina Crop Improvement Association.

PLANS FOR CROPS CONTESTS

For Students of Vocational Agriculture

I. A study of quality in seeds

The judging of seed quality of varieties *eligible to seed certification and grown in North Carolina.*

II. Crop and Variety Studies

The identification of crop varieties eligible to certification including weeds and diseases affecting the certification of seed.

Standard seed judging contests consist of *from four to seven classes of four samples each*, selected from the following crops: *Shelled corn, wheat, oats, barley, rye, soybeans, cowpeas, small seeded legumes and grasses.*

The four samples of seed in each class are ranked as to quality. The reasons for such placing may or may not be required. Factors arranged as to relative value for determining quality of various crops seed will be found on accompanying sheets.

The identification of crop varieties consist of identifying fifty specimens selected from the list on page 2. Mounted plants or seed or both are used in the contests.

Factors for Determining Quality of Grain and Small Seeds

SHELLED CORN—Factors determining quality.

A good sample of shelled corn may be described as having a bright color, uniform, plump and well-shaped kernels. The kernels should be fairly hard—not soft and starchy—free of blisters or discoloration, or excessive cob chaff at kernel tips. The sample must be pure as to variety as shown by typical color of the kernels and cob chaff, size and shape of kernels.

Defects of shelled seed corn arranged as to importance.

- Least 1. Lacking in uniformity, size, shape and color of kernels.
2. Lacking in luster of kernels.
3. Excess cob chaff adhering to kernel tips.
4. Kernels starchy.
5. Lacking in plumpness of kernel tips.
6. Germ face and kernels, blistered, discolored.
7. Presence of disease (dry rot).
Most 8. Mixture of variety (color of kernel or cob chaff).

SEED WHEAT—Factors determining quality.

A good sample of seed wheat may be described as having a bright color, uniform, plump and well-shaped kernels. The kernels should be dark in color, hard and vitreous indicating high milling quality. The sample must be pure as to variety as shown by typical kernels, uniform in color and shape. The sample must be free of noxious weeds and diseases transmitted by seed.

Defects of seed wheat arranged as to importance.

- Least 1. Lacking in uniformity, color, size and shape of kernels.
2. Lacking in luster of kernels.
3. Presence of broken kernels.
4. Lacking in plumpness and weight.
5. Mixture of other varieties or class.
6. Mixture of other crop seeds (rye, barley, oats).
7. Presence of noxious weed seeds.*
Most 8. Presence of disease (smut, scab, nematode galls).*

SEED RYE—Factors determining quality.

Same as for wheat, omitting consideration for milling quality.

OATS AND BARLEY—Factors determining quality.

A good sample of seed oats or barley may be described as having a bright color, uniform, plump and well shaped grain. The grain must be well threshed, show little or no hull damage and well cleaned. The sample must be pure as to variety, free of noxious weeds and diseases transmitted by seed.

Defects of seed oats or barley arranged as to importance.

- Least 1. Lacking in uniformity, size and shape of grain.
2. Lacking in luster, brightness of color.
3. Lacking in plumpness and weight.
4. Dehulled, skinned and broken grain.
5. Badly stained or weather damaged.
6. Mixture of other crop seeds.
7. Mixture of other varieties.
8. Presence of smut.*
Most 9. Presence of noxious weed seeds.*

LARGE SEEDED LEGUMES, soybeans, cowpeas and field beans—Factors determining quality.

A good sample of seed may be described as having a good bright natural color, uniform, plump and well-shaped seed. Practically free of

* See list under "Contents" this circular .

split or broken seed and insect damage. Free of mixture as to variety and weed seeds.

Defects of seed arranged as to importance.

- Least
1. Lacking in uniformity, size, shape and color.
 2. Presence of mottling (soybeans).
 3. Lacking in luster (color).
 4. Split and broken seed.
 5. Lacking in plumpness.
 6. Insect damage (cowpeas).
 7. Discolored and damaged seed.
 8. Mixture of variety.

- Most 9. Presence of weed seed (wild morning glory).*

SMALL SEEDS—alfalfa, red clover, timothy, lespedeza, etc.—Factors determining quality.

A good sample of small seed may be described as being free of noxious weed seed, reasonably free of semi-harmful, common weed seed, other crops' seeds and inert matter. The seed should have a bright natural color, uniform, plump and practically free of immature, brown or damaged seed.

Defects of small seed arranged in order of importance.

- Least
1. Lacking in luster (color).
 2. Dehulled seed (timothy, lespedeza).
 3. Free of broken seeds.
 4. Lacking in plumpness and color (green, brown).
 5. Mixture of other crops seeds.
 6. Presence of common weed seed.*
 7. Presence of semi-harmful weed seed.*

- Most 8. Presence of noxious weed seeds.*

GRAIN SORGHUM—Factors determining quality.

A good sample of grain sorghum may be described as having a bright color, uniform, plump and well-shaped kernels. The seed should be reasonably free of discolored, cracked and otherwise damaged kernels, other crop seeds and seed of other grain sorghums. Seed of grain sorghums should be free of sweet sorgo seed, disease and noxious weed seeds.

Defects of grain sorghum seed arranged as to importance.

- Least
1. Lacking in luster (bright color).
 2. Lacking in uniformity, size and plumpness.
 3. Red staining (blackhull kafir).
 4. Cracked and broken kernels.
 5. Discolored, weather stained, damaged.
 6. Presence of disease and insect damage.
 7. Mixture of other grain varieties.
 8. Presence of sweet sorgo seed.*
- Most 9. Presence of noxious weed seed.*

* See list under "Contents" this circular .

DESCRIPTION OF TEN LEADING VARIETIES OF CORN GROWN IN NORTH CAROLINA

All unquoted sections of this circular by
W. H. DARST, *Professor of Agronomy*, unless otherwise noted.

Latham's Double

Latham's Double is a prolific white corn developed in the Tidewater section of North Carolina. It is medium to large in maturity with good quality of grain and relatively free from diseases. It is especially adapted to the Tidewater and Coastal Plain area and usually does well in the eastern Piedmont section. Latham's Double has a medium large growth, and is well suited to silage.

Description of Ears—Color of kernel and cob, white. Ears large, slightly tapering, 8-9 inches in length. The type of ear and kernel is somewhat variable. Medium smooth to medium rough indentation. The ears have usually 16 rows of kernels, with good spacing. Kernels deep, vary from medium starchy to medium horny in texture.

Distinguishing Characteristics—Latham's Double is similar to Cocke's Prolific, but may be identified by later maturity, longer, larger ears, deeper, wider kernels and less variation in number of rows of kernels per ear.

Weekley's Improved

Medium growth and maturity, prolific, good quality of grain, well adapted to the Piedmont area.

Description of Ears—Color of kernel and cob, white. Ears medium, large, cylindrical $7\frac{1}{2}$ - $8\frac{1}{2}$ inches in length, medium smooth indentation. The type of ear and kernel is fairly uniform. The ears average 12 rows of kernels which are well spaced. The kernels are of medium depth, but wider than those of any other variety grown in the State. Kernels are medium smooth and medium horny in texture.

Distinguishing Characteristics—Weekley's Improved is distinguished by medium large, cylindrical ears, wide kernels, rather smooth and horny.

Southern Beauty

Prolific, with medium growth and earliness, good quality of grain, adapted to the Piedmont area and to the lower elevations in the mountains.

Description of Ears—Color of kernel and cob, white. Ears medium large, tapering in shape, $7\frac{1}{2}$ - $8\frac{1}{2}$ inches in length, medium rough indentation. The type of ear and kernel are fairly uniform. The ears average 14 rows of kernels with fairly close spacing. The kernels are medium deep, rather wide, and starchy in texture.

Distinguishing Characteristics—Southern Beauty may be identified by medium large ears, noticeably tapering at the tips of ear. Rather wide, starchy kernels, medium rough indentation.

Holcombe's Prolific

An early variety bred in Buncombe County, North Carolina, and well adapted to the mountain area. Medium growth and good quality of grain.

Description of ears—Color of kernel and cob, white. Ears medium small in size, slightly tapering, 7-8 inches in length. The type of ear and kernel is fairly uniform. Medium smooth to medium rough indentation. Ears average 16 rows of kernels, with very little space between rows. Kernels small, of medium depth, medium starchy in texture.

Distinguishing Characteristics—Holcombe's Prolific may be identified by the size of ear and kernels (considered small) and by the uniformity of type, similar to Shoaf's Prolific.

Cocke's Prolific

Medium to early in maturity, good quality of grain. Adapted to the Coastal Plain and Piedmont areas.

Description of Ears—Color of kernel and cob, white. Ears medium in size, slightly tapering, 7-8 inches in length. The type of ear and kernel varies. The ears vary from 14-16 rows of kernels, with good spacing. The ears vary as to smoothness, with average medium smooth indentation. The kernels are medium shallow and medium horny in texture.

Distinguishing Characteristics—Cocke's Prolific ear corn is difficult to identify. When ears of all varieties being studied are typical, the Cocke's Prolific may be identified by size and shape of ear and kernels. For comparative number of rows and smoothness of kernels, see discussions of Latham's Double and Holcombe's Prolific.

Bagley's Highland Horsetooth

A variety bred from the native Horsetooth. It was developed in the northeastern Tidewater area and is especially adapted to that region. Good quality of grain, large growth, good silage type for eastern North Carolina.

Description of Ears—Color of kernel and cob, white. Ears large, cylindrical, 9-10 inches in length—the largest ear corn grown in the State. The type of ear and kernel vary and average 14 rows of kernels per ear. Kernels are medium starchy in texture, deep and wide.

Distinguishing Characteristics—Highland Horsetooth ear corn may be easily identified by size, medium rough to rough ears, deep, wide kernels, somewhat starchy.

Bigg's Two Ear

This variety is a selection from the old Bigg's Seven-Ear variety. It was developed in the eastern Coastal Plain and is well adapted to this section and to the lower Piedmont area. It is medium late, sound and of good quality. An early strain of this variety has been selected at the mountain station and does well at lower elevations.

Description of Ears—Color of kernel and cob, white. The ears are the smallest of the white prolific varieties, 7-8 inches long, slender and slightly tapering. The type of ear and kernel is fairly uniform. Ears average 12 rows of kernels, rather wide space between rows. Kernels, medium shallow and medium hard in texture.

Distinguishing Characteristics—Bigg's Two Ear is similar to Weekley's Improved, but may be distinguished by size (somewhat smaller) and shape of ear (more slender). The ear butts frequently are flared with irregular shaped and wide spaced kernels. The ears are smoother and more uniform in type.

Jarvis Golden Prolific

Developed in Piedmont North Carolina. Medium growth, early, seed sound, of good quality. Adapted to the Coastal Plain, Piedmont and Mountain regions. A strain is being grown and selected in the Mountain area which is better adapted to that region than is seed direct from the Piedmont area.

Description of Ears—Color of kernel, yellow; cob, white. Ears medium in size, slightly tapering, 7-8 inches in length. The type of ear and kernel is fairly uniform. Medium smooth to medium rough indentation. Ears average 16 rows of kernels, often with considerable space between rows. Kernels with medium width and depth, medium horny in texture.

Distinguishing Characteristics—Jarvis Golden Prolific is like Indian Chief in color of grain but may be distinguished by longer ears, smaller kernels, with harder texture. The ears are more uniform, with smoother indentation and more rows of kernels.

Kiker Indian Chief

A prolific type of yellow corn. Medium sized ears, grain of good quality. Kernel dark yellow, occasionally tinged with red. Well adapted to the Coastal Plain and Piedmont regions.

Description of Ears—Color of kernel, yellow; cob, white. Ears small, 6½-7 inches in length, possibly having the shortest ear of the prolific varieties. Ears cylindrical, with an average of 14 rows of kernels, often with considerable space between rows with medium rough indentation. The kernels, are rather deep and wide and medium starchy in texture.

Distinguishing Characteristics—Indian Chief may be identified by the short cylindrical ears, medium rough indentation and by the rather wide deep and somewhat starchy kernels. Occasionally, an ear or kernel will be found tinged with red.

Shoaf's Prolific

A well know variety of corn grown in the Piedmont region. It is recognized, nationally as well as locally for its uniformity and as a show type.

Description of Ears—Color of kernel and cob, white. Ears medium large, cylindrical, 7½-8½ inches in length, medium rough indentation. The ears and kernels are very uniform. The ears have 16 rows of kernels and are well spaced. The kernels are deep, well-shaped, uniform and medium horny in texture.

Distinguishing Characteristics—Shoaf's Prolific may be identified by its uniform well shaped ears and kernels. Medium large, medium rough, symmetrical ears of show type.

DESCRIPTION OF TEN LEADING VARIETIES OF CORN GROWN IN NORTH CAROLINA

ITEMS OF DESCRIPTION	Bagley's Highland Horsetooth	Latham's Double	Weekley's Improved	Cocke's Prolific	Southern Beauty
Prolificacy-----	Single	Prolific	Prolific	Prolific	Prolific
Color ear	White	White	White	White	White
Color cob	White	White	White	White	White
Length ear	9-10"	8-9"	7.5-8.5"	7-8"	7.5-8.5"
Circumference	7-7.25"	6.5-6.75"	6-6.25"	5.75-6.25"	6.25-6.50"
Shape ear	Cylindrical	Slightly tapering	Cylindrical	Slightly tapering	Tapering
Number rows	14	16	12	14 and 16	14
Texture kernels	Medium starchy to starchy	Medium starchy to medium horny	Medium horny	Medium horny	Starchy
Space between rows	Wide	Medium wide to medium narrow	Medium narrow	Medium wide	Medium wide
Depth kernels	Deep	Deep	Medium shallow	Medium shallow	Medium shallow
Width kernels	Wide	Medium wide	Wide	Medium narrow	Medium narrow
Indentation	Medium rough to rough	Medium smooth to medium rough	Medium smooth	Medium smooth	Medium rough
Size ear	Large	Large	Medium Large	Medium Small	Medium Large
Size cob	Large	Medium small	Medium small	Medium large	Medium large
Size shank	Large	Medium small	Medium large	Medium large	Medium small
Uniformity of ears	Not uniform	Not uniform	Medium	Medium	Medium
Uniformity of kernels	Not uniform	Medium	Medium	Medium	Uniform

**DESCRIPTION OF TEN LEADING VARIETIES OF CORN GROWN IN
NORTH CAROLINA (Continued)**

ITEMS OF DESCRIPTION	Bigg's Two Ear	Holcombe's Prolific	Shoaf's Prolific	Jarvis Golden Prolific	Kiker Indian Chief
Prolificacy	Prolific	Prolific	Prolific	Prolific	Prolific
Color ear	White	White	White	Yellow	Yellow
Color cob	White	White	White	White	White
Length ear	7-8"	7-8"	7.5-8.5"	7-8"	6.5-7.5"
Circumference	5.6-5.75"	6-6.25"	6.5"	6.25-6.50"	6-6.25"
Shape ear	Slightly taper- ing slender,	Slightly tapering	Cylindrical	Slightly tapering	Cylindrical
Number of rows	12	16	16	16	14
Texture kernels	Medium horny	Medium starchy	Medium starchy	Medium horny	Medium starchy
Space between rows	Wide	Narrow	Medium wide	Medium wide	Medium wide
Depth kernels	Medium shallow	Medium shallow	Deep	Medium deep	Medium deep
Width kernels	Medium narrow	Narrow	Medium narrow	Medium narrow	Medium wide
Indentation	Smooth	Medium smooth to medium rough	Medium rough	Medium smooth	Medium rough
Size ear	Small	Small	Medium large	Medium small	Small
Size cob	Small	Small	Small	Medium small	Medium small
Size shank	Medium small	Small	Small	Medium small	Medium small
Uniformity of ears	Uniform	Uniform	Uniform	Medium	Not uniform
Uniformity of kernels	Medium	Uniform	Uniform	Medium	Not uniform

DESCRIPTION OF SOME LEADING VARIETIES OF WHEAT GROWN IN NORTH CAROLINA

Fulcaster

Description—"Plant, winter habit, mid-season, mid-tall to tall; stem, purple, strong; spike awned, white, mid-long, mid-wide to wide; shoulders mid-wide, oblique to square; beaks 2 to 8 mm long; awns 3 to 6 mm long; kernels red, mid-long, soft, ovate, humped; germ mid-sized; crease mid-wide, mid-deep, sometimes pitted; cheeks, usually angular; brush, mid-sized, mid-long.

History—According to Carleton (50. p. 70) "Fulcaster (reg. No. 131) was produced in 1886 by S. M. Schindel, of Hagerstown, Md., and is a hybrid between Fultz and Lancaster, the latter being the Mediterranean variety." (No. 1, p. 98).

Distinguishing Characteristics—Plant—Spike, awned. Straw below spike, purple in color.

Kernels, large; germ and brush end, large; kernel, humped just beyond germ. Crease, deep, and usually pitted. Cheeks angular.

Leap's Prolific

Description—"Plant, winter habit, early, mid-tall; spike, awnleted, fusiform, mid-dense to lax, inclined to nodding, easily shattered; glumes, glabrous, yellowish white, mid-long, mid-wide; shoulders, mid-wide, oblique to square; beaks, wide, acute 0.5 mm long; awnlets, few, 3 to 10 mm long; kernels, red, mid-long, soft, ovate; germ, small; crease, mid-wide to wide, mid-deep; cheeks, usually angular; brush, small, midlong.

History—Leap is reported to have originated from a single plant found in a field of Mediterranean by a son of J. S. Leap, of Virginia. From the five heads gathered in 1901, Mr. Leap increased the wheat until 1905, when he threshed 190 bushels grown from 10 bushels of seed. T. W. Wood & Sons, seedsmen of Richmond, Virginia, first distributed the variety as Leap's Prolific. General distribution of the wheat started about 1907, and it since has become very popular.

Distribution—Estimated area, 673,613 acres, grown in 12 states in 1929.

Synonyms—Hastings Prolific, Leap's Prolific, Wood's Prolific, Woolf." (No. 1. p. 57).

Distinguishing Characteristics—Plant—Spike awnleted, tapered at apex, inclined to nodding when ripe in field. Awnlets few and straw below, spike white.

Kernels somewhat smaller than Fulcaster, more plump and more starchy and have a smaller germ and brush end than Fulcaster. Kernels somewhat tapering toward brush end, ovate in shape.

Redhart

Description—"Plant, spring intermediate habit, mid-season, mid-tall; stem, white, strong; spike, awnleted, fusiform, mid-dense, erect to inclined; glumes, glabrous, white, mid-long to long, narrow to mid-wide; shoulders, narrow, wanting to oblique; beaks, narrow, obtuse, 1 mm long; awnlets, several, 5 to 20 mm long; kernels, red, mid-long, soft, elliptical; germ, mid-sized; crease, mid-wide, deep; cheeks, angular; brush, mid-

sized, mid-long. This variety is not so hardy as Fulcaster and Leap's, but is grown from fall seeding.

History—Redhart was selected from the southern Flint of Red May wheat by Coker's Pedigreed Seed Co., Hartsville, South Carolina.

Distribution—"The estimated area in 1929 was 2,310 acres, all in North Carolina." (No. 1. 63).

Distinguishing Characteristics—Plant—Spike, awnleted, tapering at apex, erect to inclined when ripe in field; awnlets, many, long.

Kernels, medium large, elliptical in shape, not tapering; crease, usually deep; cheeks, angular. Not so plump as Leap's.

DESCRIPTION OF SOME LEADING VARIETIES OF OATS GROWN IN NORTH CAROLINA

Fulghum

"The Fulghum oat has recently come into prominence in some sections, particularly where the Red Rustproof had been practically the only variety grown for decades. It was first grown extensively in southeastern Georgia, where it is believed to have originated. It is an awnless selection of Red Rustproof. This new variety soon became widely distributed in adjoining states, and it is now second to Red Rustproof in importance among fall-sown oats. It matures about 10 days earlier than Red Rustproof and the grain is usually lighter in color. In the field the Fulghum can be readily distinguished from the Red Rustproof by its more erect heads or panicles. The kernels of the Fulghum also are smaller and nearly free from the awns and basal hairs, characteristic of that variety; consequently its weight per bushel is usually higher. As it yields nearly or quite as well, its earliness gives it a distinct advantage." (No. 2, p. 7).

Grain Description—Plump, uniform grain somewhat smaller than Red Rustproof, Fulghum is supposed to be awnless, however, on analysis, the grain may show 10-15 per cent awned. The lower grain may bear an awn, the upper grains never bear awns.

Distinguishing Characteristics—Fulghum is distinguished from Red Rustproof by per cent of awns on back of grain. Fulghum grain about 15 per cent awned. Red Rustproof grain practically all awned.

Lee Oats

This variety is a hybrid oat distributed by the U. S. Department of Agriculture. A cross of Red Rustproof and Aurora varieties and in turn classed with the Winter Turft variety. The Lee Oat is quite variable in type, and has the characteristics of all three varieties in its make-up.

Grain Described—The grain is rather small but plump. The color of the hull varies from a distinct yellow to a dark gray. On analysis 45-50 per cent of the grains are of a bright yellow color, approximately 45 per cent are of a medium to light gray color and about 5 per cent a dark gray or nearly black color.

The Lee Oat is practically awnless, not more than one per cent of the grain bears awns. The grain may bear noticeable stiff bristles at the base, but is quite variable in this respect.

Distinguishing Characteristics—Small plump grain. Yellow to gray colored hull, in about equal numbers. A few grains bear stiff bristles at the base of the grain and may be awned.

Norton Oats

A variety of hardy winter oats developed by the Coker Seed Company. A large uniform plump oat. The grain is yellowish red in color, occasionally a grayish grain will be found. The palea or inside hull is usually a different color from the major or outer hull. Seventy per cent of the grain have dark to light gray inner hull or palea. The remaining grain have the same color as the major hull. About 40 per cent of the lower grain have awns. The awns are black in color and twisted at the base. The grains are not smooth at the base but have a small depression, characteristic of winter oats.

Distinguishing Characteristics—Large uniform grain, yellowish red in color. Seventy per cent of grain have palea or inner hull, light to dark gray color. Thirty to forty per cent of the grain, awned. Awn, twisted with black base.

Red Rustproof

“Red Rustproof is the typical winter variety of the group to which the name is here applied. Among the other names used for the same variety are Red, Texas Red, Red Texas and Texas Red Rustproof. The leaves of the young plant in the fall are medium green in color and rather broad. The plant, while spreading, is less so than most other fall sown grains. The straw of this variety is of medium height, straight and stiff. The heads are not large, but numerous. The grains are large and plump, yellowish or reddish brown in color, and usually all awned. The Red Rustproof is early in maturing and is quite free from rust. Varieties similar to the Red Rustproof, most of which are special strains of that variety which differ very slightly from it, are the Appler, Bancroft, Cook, Hundred-Bushel, McGehee, and Patterson.” (No. 2, p. 6-7).

Grain Described—Large, well-shaped with reddish brown hull. Practically all grains are awned, or if broken off by threshing or handling will show an awn scar, on back of hull. The base of grain breaks with a slight depression, and is not as smooth as the base of common white spring oats. If not broken off, the base of the kernel bears a few short stiff hair-like bristles.

Distinguishing Characteristics—Red Rustproof is distinguished from Fulghum in that practically 100 per cent of the grain are awned.

DESCRIPTION OF TWO VARIETIES OF RYE GROWN IN NORTH CAROLINA

Abruzzi Rye

Introduced from Italy by the U. S. Department of Agriculture. Especially adapted to the Southern States. Superior to common rye as a winter cover crop, pasture, and green manure.

Abruzzi rye is a fall-sown crop, out yielding common rye for grain, as well as other uses in North Carolina. Abruzzi is 10 days to 2 weeks earlier in maturity.

Distinguishing Characteristics—Abruzzi rye grain is large and plump. From light gray to dark brown in color. A pure Abruzzi grain, does not contain a distinct greenish color.

Common Rye

Common rye is not a distinct variety, since it contains a great number of unselected forms. Common rye is most widely grown in the United States and is widely adapted to the climate and soil conditions. Common rye is a fall sown crop maturing late in the spring, used generally for grain, winter cover crop, pasture and green manure.

Common rye grain is medium to small in size. Variable in color, light gray, greenish to dark brown.

Distinguishing Characteristics—Distinguished from Abruzzi on size and presence of greenish colored grain.

BARLEY

Tennessee No. 6

The Tennessee No. 6 Barley is one of many hybrids, resulting from crosses made by the Tennessee Agricultural Experiment Station, between Tennessee Winter (Bearded) and Horsford (Hooded) and Union Winter (Bearded) and Horsford (Hooded) crosses. The resulting hybrids were tested in 1920 and 1921. The hybrids No. 5 and No. 6 were found to be the best of the lot. In later tests by the Station the Tennessee No. 6 Barley has proven to be inferior as a grain crop.

Distinguishing Characteristics—A six-row Barley having a hood-like formation at the apex of the inner glumes or chaff.

The seed hull adheres closely to the kernel. Theoretically two-thirds of the grain are slightly twisted, one-third plump and straight. The threshed seed usually contain remnants of the hood as borne on inner glumes.

LEGUMES

Alfalfa

Description of Plant—"Alfalfa may be described briefly as being a deep-rooted, long-lived herbaceous forage plant belonging to the botanical family Leguminosae, or pod-bearing plants. Its flowers are violet, clover shaped, and borne in compact oblong racemes, or clusters. The pods are small, slightly hairy and spirally coiled in two or three turns. The kidney-shaped seeds are about one-twelfth of an inch long, and several are contained in each pod.

One of the most important characteristics of alfalfa is its long tap-root, often extending 15 or more feet into the soil. This enables the plant to reach stores of plant food in the soil which cannot be secured by the ordinary shallow-rooted field crops. This long tap-root is also of great importance in sections of limited rainfall, as by this means the plant is enabled to withstand extremes of drought which would otherwise be fatal." (No. 3, p. 7).

Description of Seed—Olive green to brownish green color, slightly kidney to angular in shape, similar in size and color to sweet clover.

Distinguishing Characteristics—Flowers, violet color; clustered raceme; seed pods, spiral and many seeded; three leaflets, upper one with short stem. Leaflets slightly notched at the tips only. Stipules at the base of leaf stem are narrow wing-shaped. Stems of young plants are square.

Alsike Clover

Description of Plant—"Alsike clover is a perennial but it is usually classed agriculturally as a biennial. Many smooth stalks grow up from the crown root system. The stems bear smooth leaves, each with three leaflets. The flower heads vary in color from partly pink and partly white, to all white or all pink. After the flower heads mature and fade they bend over and hang down."

The length of the stalks vary from 8 to 12 inches on poorer and dry soil to 1½ to 3½ feet on moist soils under most favorable growing conditions. Single flower bearing branches, each with one or more flower heads, arise successively from each leaf axil. The main axis keeps on growing instead of terminating in a flower or flowering branch. The leafy branches may in turn keep growing forming flower heads or smaller branches in the axil of each leaf.

The terminal heads are the last found, the older ones being successively lower on the stem. The stem, however long, may bear flower heads along its entire length. Due to its method of growth Alsike clover may be cut for hay over a longer period of time than other clovers.

Description of Seed—The seed are light to dark green in color, small heart shaped and about the same size as white clover seed.

Distinguishing Characteristics—The stems are smooth and weak. The main stem is branched but does not terminate in a flower head, thus differing in this respect from red clover. The branches off the main stem terminate in flower heads. They are small, roundish, and of a white to pinkish color.

The leaflets are joined at a common point but have no white spot in the center. The stipules at the base of the leaf stem are wide and wing-shaped.

Bur Clover

From the July, 1904, Bulletin, issued by the North Carolina State Board of Agriculture. "Bur clover (*Medicago Maculata*, Sibth). Annual, much branched, 15 to 60 branches at the base, ascending and spreading, smooth; stems 15 to 30 inches long. Leaves petioled, three-parted; Leaflets broad at the apex, pointed at the base, emarginate, cuneate, wavy margin, ⅜ by ½ inch; stipules, small dentate. Flowers yellow, ⅙ inch long, in small heads of two to four. Pods ¼ by ¾ inch, spirally twisted in two or four coils; coils flat, veined, each provided with two rows of reflex prickles. Seeds three to five to the pod, ⅓ to 3/16 inch long, strongly kidney-shaped, deep yellow in color. Nitrogen tubercules forked, rather flattened, ⅓ to ½ inch in diameter. Native of Europe and Asia supposed to have been introduced into America in ship ballast." (No. 8, p. 24).

Distinguishing Characteristics—Bur clover spreads over the ground with many branches during its growth. The leaves are trifoliate (three in a cluster) and usually have V-shaped black spots on them. The leaflets are broader at the apex than at the point of attachment.

The seed are borne in characteristic twisted pods with prickles attached. The seed are flat kidney-shaped and vary from yellow to bright brown in color. They are somewhat larger than either red clover or alfalfa.

Crimson Clover

Description of Plant—"Although crimson clover is an annual, it has a semi-biennial habit, as it, when sown in the summer or fall, will mature during the spring of the following year. It is upright in its habits of growth, and under favorable conditions attains a height of twenty to thirty inches. From the crown of the root are developed four to thirty or more erect branches on which a large amount of foliage is produced. The stems and leaves are quite hairy. The heads are terminal, being some distance above the last leaves, and are somewhat longer than those of red clover. They are of a rich, crimson color and are strikingly beautiful in their appearance. The leaves are borne on long leaf stalks. It is much earlier in maturing than red, mammoth and alsike clovers. It grows late in the fall and starts growth early in the spring." (No. 7, p. 3).

Description of Seed—They are egg-shaped, the largest of the clover seeds, and vary from flesh to reddish brown in color.

Distinguishing Characteristics—Crimson clover grows erect with the stem terminating in a spike-like raceme bearing the crimson flower. The stems and leaves are hairy. The leaflets are broader at the apex than at the point of attachment, and are much larger than the leaves of white clover. They also tend to be more rounding without the color marking that distinguish red and white clover.

Red Clover

Description of Plant—"Red clover is a biennial and is especially adapted to short rotations. It is a herbaceous plant and is composed of numerous leafy stems arising from a thick crown. The stems and leaves are hairy, with each leaf having three leaflets. The flowers are rose-pink in color and they remain erect even after the flower fades. The main axis terminates in a flower and thus limits the growth of the stem. Branches arise from the leaf axis and these in turn are terminated by flowers. Thus the terminal flower head of the main stem or branch is the oldest of the plant or branch. The flower heads of red clover are not borne at exactly the same height from the ground. There is no great differences between the levels to which the various flower heads rise."

Description of Seed—The seed are somewhat heart-shaped, deep purple to light yellow and mottled in color. They are about the size of alfalfa seed and somewhat smaller than crimson clover.

Distinguishing Characteristics—The stems and leaves are hairy. The main stems are strong and usually erect and terminate with the flower head limiting growth. The flower heads are large, slightly elongated, and of a purplish pink color. The leaflets are joined at a common point usually bearing irregular V-shaped white markings. The stipules at the base of the leaf stem are attached about three-fourths of their length.

Sweet Clover

Description of Plant—"Sweet clover is an erect-growing legume with trifoliate leaves and white, yellow, or purple flowers. It is similar to and closely related to alfalfa and true clovers. In its early stages it is difficult to distinguish from alfalfa. All sweet clovers have a bitter taste and have, when bruised, a characteristic pleasant odor due to a substance within the plant known as coumarin."

"The flowers are produced on long flowering stems, or racemes, which arise in the axils of the leaves. A raceme may bear as many as a hundred flowers. Most strains of white sweet clover (*Mililotus alba*) usually begin blooming in June about ten days after the yellow-flowered species (*Melilotus officinalis*). Blooming begins at the base of the raceme and continues to the tip. The normal blooming period for a single stem is ten days or two weeks, usually with not more than half the flowers on the raceme in bloom at one time. The shorter blooming period of the yellow species is due to the more rapid opening of the flowers."

Description of Seed—"Seeds of sweet clover and alfalfa are often confused because of their similarity, the sweet-clover seeds are comparatively short and thick and alfalfa seeds are bean-shaped. Some unhulled seeds are frequently found in a sample of sweet clover. Sweet-clover seeds have a characteristic bitter taste and sweet odor and are slightly smaller and more oval in shape than alfalfa." (No. 4, p. 211-213).

Distinguishing Characteristics—Flowers, white or yellow, produced on long flowering stems (racemes). Seed pods, dark in color bearing only one seed. Three leaflets, upper one with short stem, leaflets are notched all around the edges. Stipules are very narrow and bristle-like. The stems of the young plants are many-sided; juice of stem bitter.

The seed are olive green to yellowish green to brown, somewhat smaller than alfalfa, uniform, oval in shape with distinct crease three-fourths the length of the seed.

White Clover

Description of Plant—"White clover is a smooth perennial; the stems are slender spreading, creeping, and rooting at the joints; the leaves are trifoliate, leaflets being inversely heart-shaped, and the leaf-stalks long; the flowers are white to an occasional pale pink arranged in small globular heads on long stalks; the first is a small, usually four-seeded pod; the growing season in the South is almost the entire year except dry summer. White clover grows on a variety of soils. It is distributed throughout North America, except the extreme North and the extreme South." (No. 6, p. 30).

Description of Seed—The seed are small heart-shaped and vary in color from yellow to brown.

Distinguishing Characteristics—White clover is a dwarf low growing legume with creeping stems which root at the joints. The white flower heads are borne on the end of the long stalks. The leaflets are inversely heart-shaped each marked with a white V-shaped spot.

DESCRIPTION OF A FEW VARIETIES OF SORGHUMS

Black Amber Sorgo

Amber sorgos are easily recognized by the slender stems, a few leaves, and open, longer branching seed heads. The stems are tender, juicy, and sweet. This is the earliest maturing variety, producing seed in from 90 to 94 days. The seeds are larger than those of Sumac, yellowish brown in color, and rather elliptical in shape, and are nearly enclosed by large, pointed hulls, which are black in color. The Amber is the lightest

yielder of all, but on account of its earliness it is especially adapted to the northern region.

Distinguishing Characteristics—Heads, dark colored almost black, long and branching. Seed, elliptical in shape and are nearly enclosed in large pointed black hulls. The seed are larger than Sumac.

Honey Sorgo

Honey sorgo is a medium-tall but not an unusually coarse growing type. Its stems are very leafy, juicy and sweet. The seed head is always erect, reddish in color, and of a rather open, broom corn type. The seeds are elliptical in shape and are almost entirely enclosed by reddish, shiny hulls. It is one of the best syrup-producing sorghums, and on account of its tendency to slenderness and its leafiness it is a valuable forage sort for the southern states.

Distinguishing Characteristics—Heads, long branching, open, broom corn type, reddish in color. Seed similar to Black Amber in size, shape and covering, but have reddish shiny hulls.

Orange Sorgo

The stalk of Orange sorgo is rather large and stocky. It is less leafy than Sumac and the stem contains less juice and sugar. The stalk bears a rather compact seed head, 7 to 8 inches long. Because of the color of the hulls, which are pointed and enclose about two-thirds of the seed, the heads have a dark brown appearance. The seeds are about the size of and somewhat less elliptical than those of Amber and somewhat larger than Sumac. Orange is slightly earlier than Sumac, but does not yield as heavily.

Distinguishing Characteristics—Heads rather compact, oval in shape to elongated. Hulls dark-brown color, pointed and about the size of Black Amber. Seed two-thirds enclosed in dark reddish brown hulls about the size of Black Amber seed.

Sumac Sorgo

Sumac sorgo is the sweetest, the leafiest, and the heaviest yielder of the strictly forage varieties. It is one of the latest maturing sorghums, producing seed in from 108 to 114 days. The plant is rather stocky, bearing 14 to 16 leaves and a small compact, dark-red seed head. The seed head is made up of small, round, dark-red seeds about the size of duck shot. The seeds are only partially enclosed by short dark-colored, round glumes. This variety, unlike the others, is not readily cross-pollinated by other varieties.

Distinguishing Characteristics—Head, small, compact, and round in shape, small dark red seed and hull. The seed are the size of duck shot and only partially enclosed by short, dark-red, rounded hull.

Broom Corn

"There are two varieties of broom corn, the standard and the dwarf. These differ mainly in the height of the plant and in the length and texture of the brush. Standard broom corn makes up about one-third of the total crop of this country at present. It grows from 10 to 14 feet in height, according to soil fertility and seasonal conditions. Normally the

brush varies in length from 18 to 24 inches, and the head grows entirely out of the upper leaf sheath, or boot. The fiber usually is round and pliable but not as fine as that of the dwarf variety."

Distinguishing Characteristics—Broom corn heads, long brush-like, with brush from 18 to 24 inches long. The brush or fiber is fine, round, pliable and without branches. The seed is enclosed in the hull about the size of Black Amber sorgo seed. The color of seed hull varies from light to reddish brown.

LESPEDEZA—ANNUAL VARIETIES

Common Lespedeza

It is thought that common lespedeza came originally from the Orient and probably grew first at Charleston, S. C., about the year 1830, and was spread from there to various parts of the South. It was first grown for pasture. Later it was grown for hay. Common Lespedeza belong to the species *striata*. It is an annual. It will stand heavier and closer grazing and will reseed itself better than other annual varieties.

Distinguishing Characteristics—The plant tends to grow erect but not as erect or as tall as Tennessee 76. The leaves are composed of three leaflets. The leaflets are long and narrow. The stipules are narrow and pointed.

The seed remain in the hull when threshed. They are shaped like a shield with three distinct points opposite the base end.

Kobe Lespedeza

Mr. J. B. Norton, an explorer for the United States Department of Agriculture, found what proved to be Kobe lespedeza while on a trip in Japan during the year 1919. He gathered plant specimens near the city of Kobe, and later sowed seed from them in his garden at Hartsville, S. C. The Coker Pedigreed Seed Company of Hartsville, S. C., grew the first seed crop from Mr. Norton's selection in 1923.

Kobe is characterized by larger leaflets, stems, and seed. The shape of the leaflets are about the same as common lespedeza, but are larger and broader. Kobe matures later than Korean but is a little earlier than Tennessee 76.

Distinguishing Characteristics—The plant is much larger than common and has longer and broader leaflets.

The seed are 1 mm larger than common lespedeza. The Kobe seed are grayish brown while the common are chocolate brown.

Korean Lespedeza

Korean Lespedeza as the name indicates was first found at Sorai Beach in Korea by Dr. Ralph G. Mills. Korean lespedeza seed were sent by Dr. Mills to the United States Department of Agriculture trial grounds at Arlington Farm, Rosslyn, Virginia, about 1921. These seed were grown and proved to be the heaviest yielder of seed and forage of any of the varieties grown as far north as Washington, D. C.

This variety was introduced as Korean by the United States Department of Agriculture.

The plant is larger and coarser than common. The leaflets have a dis-

tinctive shape in that they broaden toward the apex. The stipule is broad in comparison to the narrow stipule found on the common lespedeza.

Distinguishing Characteristics—The plant is larger and coarser than common, and its leaflets are more rounding while common is oblong or long and narrow in shape. The stipules of Korean lespedeza are much larger than common. The mature plants bear special flowering branches. These branches have elongated hairy leaves placed close together giving a feathery appearance. The flowers and seeds are borne in the axils of the leaves.

The seed are oval in shape, almost the same size as common, but smaller than the Kobe. They are grayish brown in color in the hull and purple when threshed free of the hull.

Lespedeza Sericea (Perennial)

Sericea lespedeza seed were sent to the United States from Japan by Dr. Seaman A. Knapp about 35 years ago. The first plants were grown on the Arlington Farm, Washington, D. C. several years before this date.

Professor Geralk McCarthy of North Carolina planted some seed on his farm near Raleigh, North Carolina. Descendants of the original plants may still be found in waste places on this same farm. Strange to say, this variety did not become important until introduced by the United States Department of Agriculture in 1923.

Sericea is a perennial, producing a large coarse plant during the second year's growth. Mature plants reach a height of 3 to 4½ feet on good soil. The stems are very woody with light green leaves, silky on top and hairy beneath. The stems are also covered with small white hairs.

Distinguishing Characteristics—The plant is branched and very large and woody. Leaflets are long and narrow and square at the tip and somewhat pointed at the base.

The seed in the hull are dark brown, when dehulled green and oval in shape.

Tennessee 76 Lespedeza

Tennessee 76 is a selection from common lespedeza. The selection began in 1912 by S. H. Essary of the Tennessee Agricultural Experiment Station. One of the first plants found on the trial grounds at Knoxville, Tennessee was used as the parent plant of the present variety known as Tennessee 76.

It is characterized by an upright habit of growth and out yields other varieties at the Tennessee Experimental Station. It matures a little later than Kobe and several weeks later than Korean. Tennessee 76 cannot be distinguished from common lespedeza by the leaflets or the seed.

Distinguishing Characteristics—It grows erect even when the plants are isolated. It is much more erect and usually taller than the common.

Tennessee 76 seed are indistinguishable from common lespedeza.

SOYBEANS

Plants of the varieties are so similar that seed are usually relied upon to distinguish the varieties.

Biloxi

"Introduced under S. P. I. No. 23211 from Tangsi, China, in 1908. Plants stout, erect, bushy, maturing in about 165 days; pubescence, tawny; flowers, purple, 85 to 90 days to flower; pods 2 to 3 seeded; seeds dark brown with brown hilum, about 1,875 to the pound; germ, yellow; oil, 20.1 per cent." (No. 10, p. 6).

Distinguishing Characteristics—Hilum and seed coat brown, seed large 10 to 11 mm long, 7 to 8 wide, 6 to 7 thick.

Herman

"Introduced by the North Carolina Agricultural Experiment Station as Haberlandt No. 38. Plants stout, erect, bushy, with a tendency to lodge on fertile soils, maturing in about 140 days; pubescence tawny, flowers purple, 50 to 60 days to flower; pods 2 to 3 seeded; seeds, straw yellow with dark-brown hilum, about 2,450 to the pound; germ yellow; oil 18.5 per cent." (No. p. 7-8).

Distinguishing Characteristics—Seed cream to straw color, hilum dark-brown to black, 5 to 6 mm long, 4 to 5 wide, 4 to 5 thick. Somewhat spherical in shape.

Laredo

"Introduced under S. P. I. No. 40658 from Yangpingkwan, China, in 1914. In China this variety is said to be adapted to drier lands than other varieties. Plants, slender, erect, inclined to lodge on fertile soils, maturing in about 140 days; pubescence, tawny; flowers, both purple and white, 70 to 75 days to flower; pods, 2 to 3 seeded; seeds, black with black hilum, about 7,776 to the pound; germ, yellow; oil, 14.0 per cent. The Laredo is highly resistant to wilt and nematodes." (No. 10, p. 8).

Distinguishing Characteristics—Seed covering and hilum, black, 6 to 7 mm long, 4 to 5 mm wide, 2 to 3 mm thick. Sides, flat, somewhat oblong to egg shape.

Mammoth Yellow

"One of the early importations, but exact date and origin seems somewhat indefinite. A late-maturing (140 day) seed type of bean adapted to a wide range of soil conditions. . . .

Plant and Seed Characters—Plants erect, bushy, stems large and coarse; leaves medium size; pubescence, gray; flowers, white; pods, straw yellow; seed, medium large, 2,145 pound, almost spherical in shape; seed coat, cream buff; hilum, fawn color to bone brown (light to dark brown); cotyledons, yellow." (No. 11, p. 522-523).

Distinguishing Characteristics—Seed, cream to straw color; hilum, light to medium dark brown, 7 to 8 mm long, 6 to 7 mm wide, 5 to 6 mm thick, somewhat spherical in shape.

Otootan

"Introduced from the Hawaiian Islands in 1911 by C. K. McClennad, Georgia Agricultural Experiment Station. It is said to have come origi-

nally from Formosa. Plants, slender, erect, bushy, but lodging under favorable conditions, maturing in about 175 days; pubescence, tawny; flowers, purple, 90 to 95 days to flower; pods, 2 to 4 seeded; seeds, black with black hilum, about 6,150 to the pound; germ, yellow; oil, 17.7 per cent." (No. 10, p. 9-10).

Distinguishing Characteristics—Seed covering and hilum black, 6 to 7 mm long, 5 to 6 mm wide, 4 to 5 mm thick. Spherical in shape.

Tokyo

"Introduced under S. P. I. No. 8424 from Yokohama, Japan, in 1902. Plants, stout, erect, bushy, maturing in about 140 days; pubescence, gray; flowers, both purple and white, 70 to 75 days to flower; pods, 2 to 3 seeded; seeds, yellowish green with pale hilum, about 2,260 to the pound; germ, yellow; oil, 18.4 per cent." (No. 10, p. 10).

Distinguishing Characteristics—Seed, olive yellow; hilum, pale, 7 to 8 mm long, 6 to 7 mm wide, 5 to 6 mm thick, somewhat spherical in shape.

Virginia

"A selection from the Morse made by representatives of the U. S. D. A. in 1907. A medium-late 125 day bean of a hay type, doing unusually well on the poorer types of soil. . . . Has a tendency to lodge badly on rich soils but stand much better on poorer soils, giving a surprisingly large yield of either hay or seed under such conditions.

Plant and Seed Characters—Plants, slender, twining; leaves, medium size; pubescence, tawny; flowers, purple; pods, tawny and distributed throughout the length of the long, slender stem; seed, medium-small (4,092 per pound) oblong, much flattened; seed coat, medal bronze (greenish brown) to Prouts brown (dark yellowish brown); hilum, olive brown; cotyledons, yellow." (No. 11, p. 525).

Distinguishing Characteristics—Seed coat and hilum olive to brown in color, 8 to 9 mm long, 5 to 6 mm wide, 4 to 5 mm thick; seed, flat, somewhat oblong to kidney shape.

COWPEAS

Blackeye

"The Blackeye varieties are quite numerous and are very similar to each other, the name applying in general to all white sorts with a black eye. The varieties of this group have been grown as a table vegetable since ancient times. One of the earliest forms is the Extra Early Blackeye, a sort adapted to the northern part of the cowpea region. The California Blackeye is grown quite extensively throughout the interior valleys of California." (No. 12, p. 6).

Distinguishing Characteristics—The seed coat is white with a blackeye. The size varies from small to large.

Brabham

"The Brabham cowpea originated as a natural cross between the Iron and Whippoorwill varieties. It has the tall habit and prolificacy of the Whippoorwill with the resistance to wilt and root-knot of the Iron variety. The Brabham is especially adapted to the sandy soils of the South where

wilt and root-knot prevail. Plants, tall, half bushy, very prolific; pods, held high, the first maturing in about 90 days; seeds, buff, marbled with brown." (No. 12, p. 4).

Distinguishing Characteristics—The seed coat is buff with brown marbling. The seed are of medium size, angular with square ends.

Clay

"The term Clay is applied commercially to a group of medium-late varieties with buff-colored seed rather than to any one sort. The Iron cowpea is not included in the Clay group. There are many buff-seeded varieties, all of which have practically the same habit of growth, but they differ slightly in time of maturity, size and form of seeds. The sorts which mature their first pods in about 110 days or less make up the most of the seeds sold as Clay, while the sorts requiring 110 days or more to mature the first pods are called Wonderful or Unknown. On account of its large vigorous growth, the Clay group, especially the Unknown or Wonderful, is grown to a considerable extent for forage and soil improvement." (No. 12, p. 5).

Distinguishing Characteristics—The seed coat is cream buff. The seed are medium sized and somewhat larger than Iron.

Groit

"The Groit cowpea is a natural cross between the New Era and Whippoorwill varieties. It has been much confused with the New Era, but in general is from 20 to 25 per cent better and is largely replacing it. Plants, sub-erect, half bushy, very prolific; pods held high, the first maturing in about 80 days; seeds, with a ground color or buff, marbled with brown and thickly sprinkled with minute blue specks." (No. 12, p. 4).

Distinguishing Characteristics—The seed coat has brown marbling and blue specks. The seed are larger than New Era.

Iron

"The Iron variety is especially valuable on account of its immunity to root-knot and wilt and is largely grown where these diseases prevail. The Iron is not a heavy yielder of seed. It has harder seed, volunteers more readily, and retains its vitality better than other sorts. Plants tall, half bushy, moderately prolific; pods held medium high, the first maturing in 90 to 100 days; seeds cream buff to vinaceous buff." (No. 12, p. 4).

Distinguishing Characteristics—The seed coat varies from cream buff to brown after exposure to the air. The seed are of medium to small size and angular in shape.

New Era

"The New Era is one of the important commercial varieties of cowpeas. It is especially valuable on account of its earliness, its erectness, and the smallness of the seed. It usually produces a heavier yield of seed than the Whippoorwill. Plants, tall, erect, half bushy, very prolific; pods held high, the first maturing in about 75 days; seeds, thickly and evenly speckled with blue." (No. 12, p. 4).

Distinguishing Characteristics—The seed are buff with fine blue specks evenly distributed over the seed coat. The seed are similar to but smaller than Groit.

Taylor

"The Taylor variety, known in various localities as the Gray Goose, Gray Crowder, Whittle, and Speckled Java, has the largest seeds of all cowpeas handled by growers and seedmen in this country. In many sections the Taylor is considered a valuable variety, but in general its habit of growth is low and the pods are held so near the ground that it is practically impossible to harvest them with a mower. Plants, low, half bushy, prolific, pods held low, the first maturing in about 90 days; seeds, thickly speckled with blue, the blue specks arranged in groups." (No. 12, p. 5).

Distinguishing Characteristics—The seed coat is buff with blue specks arranged in groups. The seed are large.

VETCH**Austrian Winter Peas**

Description—"The Austrian winter field pea (*Pisum arvense*) is a cool weather legume that closely resembles the garden or English Pea and the sweet pea in habit of growth and appearance. On fertile soil the climbing vines may reach a length of five or more feet.

The flower is reddish purple in color, resembling a small sweet pea blossom. Blooming generally commences in April.

The seed are of a brownish mottled color, somewhat larger than hairy vetch seed and are borne in small pods that ripen in May." (No. 18, p. 2).

Distinguishing Characteristics—Plants similar to garden pea. Seed greenish-gray to brown, round and dimpled. They are about 5 mm in diameter.

Hairy Vetch vs. Smooth Winter Vetch

"Hairy vetch is one of the oldest and most commonly used green manure crops of the cotton belt. Being one of the most winter hardy of the vetches, it seldom suffers any winter injury. It is usually considered as a winter annual, although it often carries over into the second year as a biennial when sown in the spring. The stems are comparatively weak or viny, ascending only with support. It has a higher minimum of zero growing point than other vetches that are less winter hardy, so that in seasons with a low mean temperature less growth may be expected from this variety than from others with a lower zero growing point. In mild winters, however, or winters having a high mean temperature, hairy vetch may yield as heavily as any less hardy variety. The seed of this variety cannot be distinguished from that of smooth vetch, and the two varieties are being sold under the name hairy vetch. In growth, however, the two varieties are very distinct, the hairy vetch having long hairs on the stems and leaves, while the smooth vetch has fewer and less conspicuous hairs. A tufted growth at the ends of the stems of hairy vetch is also characteristic. The flowers of hairy vetch are a little larger than those of smooth vetch and of a less reddish-purple color." (No. 13, p. 12-13).

Distinguishing Characteristics—Hairy is distinguished by beans and stems covered by fine hair. Smooth vetch as the name indicates is free of hairs on leaves and stems. The seed of hairy and smooth vetch cannot be distinguished. The flower clusters are a little larger in hairy vetch than in smooth vetch. The hairy vetch plant is distinctly hairy while

smooth vetch has very few or no hairs at all. A tufted growth at the ends of the stems of hairy vetch is also characteristic.

Velvet Beans

"The velvet bean is the most vigorous-growing annual legume cultivated in the United States, the vines often reaching a length of more than 50 feet. The leaves are petioled and trifoliate. The membranous leaflets, which are shorter than the petiole, are from 3 to 10 inches long and about two-thirds as broad, the terminal one being rhomboid-ovate and the lateral ones obliquely so. The flowers of the different varieties, which vary in color from white to dark purple, are 1 to 1½ inches long and are borne singly or in two's or three's in long pendent clusters.

Velvet-bean pods are of two distinct types, one being covered with a dense, black, velvety pubescence, as in the Florida and Alabama varieties, while in the other type the pubescence consists mostly of short white or grayish hairs, as in the Lyon and Chinese varieties. In all kinds, the pods are covered with more or less numerous short bristles which cause a slight irritation of the skin. Much of this pubescence falls off soon after maturity. The pods of some varieties are only 2 to 3 inches long, while those of others may reach a length of 5 to 6 inches. The seeds vary from nearly white to marbled brown, brown and black. Varieties which commonly produce marbled seeds may produce occasionally an entirely white or an entirely colored seed.

Velvet beans have numerous rather fleshy surface roots, which are often 20 to 30 feet long and abundantly supplied with nodules varying from one-fourth to one and one-half inches in diameter. The plants are rarely attacked by root-knot and are immune to wilt." (No. 19, p. 1, 2).

Distinguishing Characteristics—Velvet beans have either a bunch or viney habit of growth. The leaves are petioled and trifoliate. The leaflets are shorter than the petiole, and the terminal one egg-shaped, and the lateral ones lobed. The pods are borne on a single raceme usually in large clusters. The seeds are nearly spherical in shape, 10 to 12 mm long, to 10 mm wide, 6 to 8 mm thick. The hilum is usually surrounded by a light color mottled with brown but sometimes it is solid white or brown.

SWEET POTATOES

Big-Stem Jersey

"The vines are moderately large; long, 6 to 12 feet; stems green, hairy; leaves shouldered or entire, hairy above and smooth beneath, green; petiole hairy, green. Roots russet yellow in color, smooth and regular, long fusiform in shape, may be veined or smooth, small to large in size, but larger than Yellow Jersey or Red Jersey; season medium to late; flesh yellow." (No. 24, p. 22, 23).

Porto Rico

"Vines medium to long, 5 to 10 feet; stems coarse, internodes short, reddish purple in color, hairy especially at the nodes and on young growth; leaves shouldered, large in size, green except purple at base of blade and on veins, slightly hairy on upper surface, smooth below; petioles

medium long, 5 to 8 inches, reddish purple in color, deeper at the base of the leaf blade, color extends up on veins of lower side of leaf, color also deeper at base of petiole. Roots light rose to rose in color, fusiform to globular and irregular in shape, smooth, flesh orange-yellow to salmon." (No. 24, p. 23).

Nancy Hall

"Vines medium in length 4 to 8 feet; stems somewhat hairy, green; leaves toothed or entire with 4 to 10 low marginal teeth, hairy on upper surface and slightly hairy or smooth beneath, green except a reddish purple stain at the juncture of the blade and petiole, the latter slightly hairy, green except at upper end. Roots yellow tinged more or less with salmon, veined, or smooth and regular, fusiform in shape, medium to large in size; season early; of excellent quality." (No. 24, p. 23).

GRASSES

Bermuda Grass

"Bermuda grass (*Cynodon dactylon*) is so well known that a detailed description is unnecessary. Sometimes, however, the grass is confused with crab-grass or crowfoot, and water Bermuda grass. It is distinguished from all of these plants, however, by the ring of white hairs at the base of each leaf blade. Another conspicuous characteristic of the plant is the mass of creeping stems or runners which it produces. It is by no means exceptional to find runners many feet in length, usually forming a matted growth, well adapted to withstand grazing and trampling. The combination of the creeping stems above the ground and of root-stock immediately below the surface makes Bermuda grass pernicious when growing where it is not desired. From the creeping stems, upright branches arise at intervals to a height of 6 to 12 inches, and sometimes taller. Each flowering branch is crowned by a cluster of three to five slender ascending spikes arranged like the rays of an umbrella. The stems of the grass are compressed and consist of numerous joints, each of which, if separated, may grow readily into a new plant." (No. 25, p. 4-5).

Distinguishing Characteristics—The plant is distinguished from the crab grass by a ring of white hairs at the base of the leaf blade. The flowering stems form a compound spike with 2 to 5 racemes which are joined at a common point. The plant has a creeping habit of growth by means of stems above and below the ground.

The seed are angular and pointed about the same size as carpet grass. They are light gray in color. They are 2 mm long and 1 mm wide.

Carpet Grass

"Carpet grass (*Paspalum compressum*) is a slender, erect perennial six to twenty-four inches high; the creeping branches root at the joints and send up numerous leafy, flower-bearing branches; the head consists of two to four slender branches, each two or four inches long; the plant produces seed freely; the growing season is April to October. Carpet grass is common on low ground and in moist pastures on the coastal plain from Virginia to Texas." (No. 6, p. 22).

Distinguishing Characteristics—The plant is creeping in habit of growth

with compressed buds and flat blades. The compound spike usually has 3 racemes, with two at the top joined together at a common point and one, rarely two or three, joined at different intervals down the stem.

The seed are flat-oval in shape and of medium size. They are full gray in color with a distinct hairy base, 2mm long and 1 mm wide.

Dallis Grass

"Dallis grass (*Paspalum dilatatum* poiret) is known also under the names of large water grass, golden crown grass, and hairy-flowered paspalum. It is a smooth perennial, with a deep, strong root system and grows in clumps or bunches 2 to 4 feet high. The leaves are numerous near the ground but few on the stems. The stems are slender and usually drooping with the weight of the flower clusters.

Dallis grass produces seeds rather freely, but owing to the fact that they ripen from the tip downward and shatter off as soon as ripe, good visable seeds can be gathered only by hand. Seed is high-priced and usually of low germination." (No. 14, p. 30-32).

Distinguishing Characteristics—The plant produces erect flowering stems from a prostrate (flat) base. These stems bear 3 to 5 racemes originating at different points along the flowering stem. The spikelets are single flowered. The seed are flat-oval in shape 2 to 3 mm long and 2 mm wide.

German Millet

German millet (*Setaria Italica*) is an annual grass cultivated as a hay catch crop in the great plains and humid areas of the United States. It belongs to the foxtail millet group, so named because of the peculiar flowering heads similar to a foxtail. The plant grows erect bearing wide smooth leaves on solid stems with a rather loose-lobed head with purplish colored bristles.

Distinguishing Characteristics—The foxtail-like heads with purplish bristles and coarse solid stems bearing large wide leaves easily identifies this variety. The seed are straw color, shiny in appearance, flat-oval in shape and 3 to 4 mm in length.

Italian Rye Grass

"Italian rye grass (*Lolium multiflorum* Lamarck; *L. italicum* R. Brown) is readily distinguished from perennial rye grass by the awn on each floret and by the young leaves being enrolled at first. The grass is not truly an annual, but under farm conditions few of the plants live more than one year. Each plant under favorable conditions make a round bunch with two or more flowering shoots 1½ to 3 feet high. Many varieties have been distinguished, based on different criteria." (No. 14, p. 27).

Distinguishing Characteristics—The plant produces as many as twenty stems. The flowers are borne on a spike with 6 to 8 flowers per spikelet. The seed are medium large, about 7 mm long and 1.5 mm wide. The rachilla is flattened, narrow at the base and gradually widening out toward the summit. The Italian rye grass seed bear an awn while English rye do not.

Japanese Millet

Japanese millet (*Echinochloa frumentacea*) is an annual grass widely used throughout the humid regions of the United States. This variety is also used as hay catch crop but varies greatly from the German millet in appearance. Japanese millet is very similar in appearance to barnyard grass, a common weed found throughout the country. The plant grows erect producing many leaves and secondary stems. The heads are in the form of a compound spike. The spikes are borne alternately but rather closely grouped on the main stem.

Distinguishing Characteristics—The closely grouped spikes of the compound spike (main head) are characteristic. The flower head is of a dull gray color and does not bear awn. The seed are flat-oval in shape having a shiny appearance of light to dark gray color and about 2 to 3 mm long.

Kentucky Blue-Grass

"Kentucky Blue-grass (*Poa pratensis*) is, with the possible exception of timothy, the most noted grass in North America. Perhaps on account of the famous blue-grass country in Kentucky the opinion prevails that the grass is a true native. Such, however, is not the case, the blue-grass did not grow in Kentucky when Boone discovered that attractive region. Like most of our best cultivated grasses, blue-grass is a native of the Old World, where it occurs natural over much of Europe and Asia. It was brought over by the early colonists as one of the species contained in mixed grass seeds, and, like some of the others, found the soils and climatic conditions congenial. The name blue-grass has been supposed to be due to the purplish color of the flowers, but there is good evidence that the name was first applied to Canada blue-grass, which has bluish foliage, and was later transferred to the really green plant now called Kentucky blue-grass.

Kentucky blue-grass has creeping underground stems, each bearing a tuft of leaves at the tip. Unlike some other grasses Kentucky blue-grass blooms but once each season. When not in bloom it can usually be recognized by the leaves, which are V-shaped in cross sections, and by the peculiar leaf tip, which resembles the bow of a boat." (No. 14, p. 6-7).

Distinguishing Characteristics—The plant produces a uniform sod by means of underground stems. The leaves are V-shaped on cross section with the tip resembling the bow of a boat. The mid-vein of the leaf blade is prominent, with a short ligule (little tongue) attached to the base of the blade. The flower head is open with the lowermost branches normally in a whorl of five branches. The spikelets are crowded with 3 to 5 flowers per spikelet.

The seed are medium sized, from 3 to 4 mm long. They are ovate, lanceolate, broadish near the center, and acute at tip in shape, and have brownish straw color. The seed have distinct veins on either of the mid-rib of the major glume.

Meadow Fescue

"Meadow fescue (*Festuca elatior*) also called English blue-grass and, in the South, Randall grass, is a hardy perennial grass attaining a height of 15 to 50 inches, or even more on rich land. It does not propagate by root-stocks or form a heavy sod, neither is it inclined to be so bunchy,

as orchard or tall meadow oat grass. Its leaves are bright green and very succulent. The seed are produced in abundance in open panicles, similar to Kentucky blue-grass, although much larger and more easily harvested.

Meadow fescue is useful as a pasture grass, and it makes a very good quality of hay and gives a fair yield. On average land 2 tons per acre is not exceptional, and it is possible to produce even more than this under proper treatment. Where the hay is used it is considered of very good quality, but it is nowhere grown in large quantities. Meadow fescue does not reach its highest state of productiveness as quickly as timothy but usually persists much longer." (No. 14, p. 17-18).

Orchard Grass

"Orchard grass (*Dactylis glomerata*) is a well-known standard grass which is grown to some extent in nearly every state in the Union and quite commonly in the region east of the Mississippi River and north Alabama and Georgia. It attains most importance, however, in Kentucky, southern Indiana, Tennessee, North Carolina, Virginia, West Virginia, and Maryland, and seems thoroughly adapted to a variety of soils in these states. It was first cultivated in Virginia in 1760, although the grass is a native of Europe.

Orchard grass is readily distinguished by its large circular bunches, folded leaf blades, and compressed sheaths, and by the peculiar form of its flower heads. The shape of the head has suggested the common English name of cocksfoot. Its ability to grow in the shade of trees is responsible for the name orchard grass." (No. 14, p. 9-11).

Distinguishing Characteristics—The plant grows in large circular bunches. Its leaf blades are folded. The sheaths are compressed. The flowers are borne in compact clusters on brached panicles.

The seed are from 8 mm to 9 mm long including awn point. It is strongly compressed and somewhat flattened on the sides, with the awn and tip forming a curve which makes the seed appear sickle shaped. The color of seed is pale yellowish white.

Redtop

"Redtop (*Agrostis alba*) is the only grass of much prominence as a hay plant among the many grasses belonging to the genus *Agrostis*. It was early introduced into the American colonies. This grass has been known under many common names, such as whitetop, florin, white bent, and herd's grass. As all of these names belong more properly to grasses they should not be used for redtop.

It is a perennial grass, with a creeping habit of growth, which make a coarse, loose turf. It matures at about the same time as timothy. The leaves are about one-fourth of an inch wide and the stems slender. The loose widely branched panicle has a reddish color at maturity.

No other grass will grow under as great a variety of conditions as redtop. It is the best wet-land grass among the "tame" species. It will grow on soils so very poor in lime that most other grasses fail. It is strongly drought resistant and is often used for holding banks to prevent erosion. Redtop is second only to blue-grass as a pasture plant in the

northeastern part of the country. It is a vigorous grower and will form a good tuft in a short time.

Most of the seed of redtop is produced in southern Illinois. The seed is smaller than that of any other commercial grass and for that reason should be comparatively free from impurities, as it is easily separated from other seeds by screening." (No. 14, p. 7-8).

Distinguishing Characteristics—The slender stems with the loose, widely branched reddish panicles and single flowered spikelets make it easy to identify as a plant. The seeds are very small, both hulled and unhulled. They are slender and pointed and silver-whitish and amber.

Sudan Grass

"Under cultivation in the United States, Sudan grass has shown itself to be distinctly an annual. Only under practically frost-free conditions, such as obtained along the Gulf coast and in southern California, have plants lived over winter. This grass is very closely related to the cultivated sorghums and hybridizes with them readily. The fact that it has not root-stocks places it nearer the cultivated sorghums than Johnson grass, though for many years Johnson grass has been credited by some botanists with being the primitive form of the sorghums.

Sudan grass when seeded broadcast or in drills grows about 3 to 5 feet high and has stems about three-sixteenths of an inch in diameter (a little smaller than a lead pencil). If grown in rows and cultivated, it reaches a height of 7 to 8 ft. and stems are about $\frac{1}{4}$ inch in diameter. The panicle is loose and open, very much like that of Johnson grass, but a little larger and a little less open. The hulls or glumes are awned and when in flower are often purplish in color. This color usually fades to a pale yellow when ripe. The awns are broken off in threshing, so that the commercial seeds rarely have awns. The leaves are broader and more numerous than those of Johnson grass, giving the grass a much more favorable appearance as a hay plant. The most important difference, however, is that the aggressive underground stems, or root-stocks, with which Johnson grass is equipped, are entirely absent in Sudan grass. Sudan grass, like the cultivated sorghums, never develops anything but fibrous roots, therefore, it cannot become an obnoxious weed as the perennial Johnson grass does. Furthermore, it has shown no tendency to persist in fields as an annual weed through volunteer seeding." (No. 15, p. 1-4).

Distinguishing Characteristics—The only way to distinguish the plant from Johnson grass is by the absence of root-stock. Sudan grass does not have root-stock. The seed are usually larger and have only a third or less of the red colored seed. The two rachillas of the Johnson grass seed have rachilla that tend to remain on the seed, and the top portion of the rachilla is larger than the base. The seed are oval, somewhat flattened and pointed. They are 5 to 6 mm long and 2 to 3 mm wide.

Tall Oat

Tall oat grass (*Arrhenatherum elatius*) is a very common grass found in open ground and waste places throughout the eastern and northern United States; introduced from Europe and escaped from cultivation.

When seeded it is used as a meadow grass but is considered of rather poor quality for hay.

Tall oat grass produces many tall slender stems. The panicles resemble those of wild oats. The flowers bear a twisted awn originating on the back of the major glume similar to wild and cultivated oats.

Distinguishing Characteristics—The panicles are rather large with short branches having the appearance of wild or cultivated oats. The seed are large and chaffy averaging about 7 mm to 8 mm long characterized by a tenacious, twisted awn borne on the back of the major glume or chaff. The seed is similar to a small oat grain in appearance.

Timothy

“Timothy (*Phleum pratense*) is one of the best known of all grasses and is not likely to be confused with any other.

Timothy is well adapted to the northern half of the United States and somewhat farther southward in the mountains. The southern limit of its successful culture is approximately the same as the northern limit of cotton culture. To the northward it will produce well and survive the winters practically up to the Arctic.

Timothy differs in one respect from most other grasses in that one (sometimes two) of the lower internodes is swollen into an ovoid body, referred to as a “bulb” or “corm,” but in reality only a thickened internode. Each one of these “corms” is annual in duration, forming in early summer and dying the next year when the seed matures.

Timothy consists of many different strains, so that there are large possibilities of improvement by selecting the most desirable forms. Already much has been done along this line to produce improved varieties.” (No. 14, p. 4-5).

“Timothy is a perennial with erect, simple stems one to four feet high, and with a dense, cylindrical, spike-like panicle one to four inches long. This grass is a native of Europe, but is now much cultivated throughout the North and is naturalized throughout the whole country. Wild plants are occasionally found in Mississippi.”

Distinguishing Characteristics—It grows in clumps and is erect with simple stems. Its blades are flat and elongated. The panicles are dense, cylindrical and **spike-like**. The spikelets are single-flowered and laterally compressed. The seed thresh in the hull unless harvested in an over-ripe condition. The seed are small, from 1.5 mm to 2 mm long. Hulled seed are roundish in shape and acute at the base. Unhulled seed have a silver white color, while the hulled seed are light amber color.

PEANUTS

Spanish

“Small podded variety, strong grower, stems upright, foliage abundant and heavy; pods clustered about base of plant; usually two seeds in a pod, entirely filling the pod; color of peas light brown, pods adhere well to plant in digging. This variety frequently yields 60 bushels of marketable peas and a ton of hay to the acre. The peas of this variety are rich in oil content. The weight per bushel of Spanish peanuts is 30 pounds.” (No. 20, p. 29).

Distinguishing Characteristics—Small-podded variety with two seeds per pod. The seeds are light brown in color.

Valencia

“A very promising variety introduced from Spain. Similar in many respects to the Tennessee Red, but of much better quality. A desirable sort for the manufacture of peanut butter, also blanched and salted peanuts. A heavy yielder and matures in about 120 days.” (No. 20, p. 29).

Distinguishing Characteristics—Pods are medium large with two to three seeds per pod. The seeds are red in color.

Virginia Bunch

“Large podded variety, plant rather dwarf, stems upright, foliage rather light; pods clustered about the base of plant; usually two, sometimes three seeds in a pod, pod bright and clean, color of peas light brown; pods adhere well to plant in digging. The customary weight per bushel of this variety is 22 pounds.” (No. 20, p. 26).

Distinguishing Characteristics—Large-podded variety, two and sometimes three seeds in a pod. Seed, light brown in color.

IRISH POTATOES

Irish Cobbler

The Irish cobbler variety of potato is probably the most extensively grown of the early maturing sorts. For many years it has been the leading market variety grown in the Atlantic Coastal Plain region, from Long Island south to Georgia.

Distinguishing Characteristics—(limited to tubers) Irish cobbler tubers are roundish-flattened and sometimes angular in shape. The stem end is usually deeply depressed and the bud end slightly flattened. The skin is light creamy white in color, usually smooth but sometimes partially netted. The eyes are medium in number and shallow to medium in depth.

Green Mountain

The green mountain potato is one of the most important and widely grown late or main crop variety. It is especially adapted to northern latitudes or altitudes having abundant rainfall and where summer temperature is not exceedingly high.

Distinguishing Characteristics—(limited to tubers) The green mountain variety is easily distinguished by the shape of tuber. They are oblong-flattened, with one or both ends blunt. The eyes are shallow and well distributed. The stem and bud ends are fairly smooth and not depressed as found in the cobbler. The skin is dull or creamy white in color depending on the amount of netting. The tuber may be partially or wholly netted.

NOXIOUS WEEDS

Field Dodder

Dodder or love vine is a parasitic plant living on species of legumes i.e. clovers, alfalfa, lespedeza, mung bean, etc. There are several species of

dodder all of which are annuals. These differ slightly in manner of growth, size of seed and as to the host plant on which they thrive. Dodder is widely spread throughout the United States.

Description—Dodder reproduces by seed from year to year and by broken strands during the growing season. If the seedling plants produced by the seed come in contact with a host plant, the threadlike stems twine about it, and, by means of sucker-like growths on the stem, soon live upon the plant to which it is attached.

Distinguishing Characteristics—Dodder appears on legumes as reddish-yellow threadlike stems twining and climbing on the host plant. Dodder has no chlorophyll or green coloring-matter nor does it have leaves as other plants. Flowers are developed in clusters on the stem and in turn seed are borne in small capsules. The seed vary somewhat in size and shape depending upon the species. In general the seed are small, 1 mm (about the size of Alsike clover seed), roundish, and sometimes angular in shape. The seed coat is rough or slightly pitted and dull gray.

Wild Onions

Wild onions are perennials, living from year to year by means of bulbs formed at the base of the stem and from seed, as well as bulblets, developed in the flowering heads. Wild onions are sometimes called meadow garlic and are widely scattered over the United States. They thrive on rich soil particularly in small-grain crops. The small bulblets as developed in the flowering heads are carried in the threshed grain of wheat, oats, barley and rye.

Distinguishing Characteristics—Wild onions are very similar to the cultivated species. The stems are simple, the flowers as well as the small bulblets are borne at the end of the main stem in roundish clusters. Onion seed are produced in 3 to 6 seeded capsules, they are oval in shape, glossy black in color measuring about 3 mm in diameter.

Corn Cockle

Corn cockle is a winter annual, reproducing by seed alone. The weed is most commonly found in winter wheat, rye and oat fields throughout the country.

Distinguishing Characteristics—The plants grow erect 2-3 ft. in height. The leaves are long and slender attached to the stem in pairs on opposite sides. The stem and leaves are covered with short silky hair. The flowers are dark-purple in color and the seed are contained in well developed capsules. The seed are black in color, triangular in shape, with roundish backs. The seed coat is covered with rows of pointed projections.

Johnson Grass

Johnson grass is a perennial, reproducing by seed and underground root-stocks. This weed is wide-spread throughout the southern states and is limited in the North by severe winter freezing.

Description—Johnson grass grows erect 3-6 feet tall depending on the fertility and moisture in the soil. The habit of growth, the stem and leaves are similar to the cultivated sorghums and Sudan grass. The flowering heads are open and many-branched quite similar to the flowering

heads of Sudan grass, however, Johnson grass has a larger number of flowering heads with reddish colored seed.

Distinguishing Characteristics—Johnson grass is very similar to Sudan grass in appearance. It is distinguished by the presence of root-stocks. The seed are oval-flattened and somewhat pointed in shape. The seed coats are thick and glossy, the majority of them being a dark reddish color, the remaining straw color.

Buckhorn

Buckhorn is a perennial, reproducing by means of seed and new shoots from the old roots. It is a weed commonly found in meadows, pastures, and lawns all over the United States.

Description—Buckhorn flowering stems grow erect 1-2 feet tall, the leaves are long and slender, and are all attached at the base of the plant. The flowering head is a short cylindrical spike at the end of unbranched flowering stalks.

Distinguishing Characteristics—The plant has long narrow leaves all attached at the base of the plant. The stalks are long, unbranched, flowering with short terminal spikes. The seeds are glossy, light to dark brown in color, boat shaped and measuring 2 mm in length.

Field Sorrel

Field sorrel is a perennial, reproducing by means of seed and underground rootstocks. It is a common weed in old pastures and meadows throughout the U. S.

Description—The plants grow erect 1-2 feet in height and the leaves are arrow-head shaped. The flowering heads are many branched and finely divided, usually of a reddish brown color at maturity.

Distinguishing Characteristics—The plants have arrow-head shaped leaves, sour to the taste. The flowering heads are fine and many branched, reddish in color. Seed, small (1 mm) triangular in shape, glossy, reddish brown in color. The seed are usually covered with dull brown hulls.

Curly Dock

Curly Dock is a perennial, reproducing by seed only. It is common to old pastures and meadows through the upper two-thirds of the United States.

Description—Curly dock grows erect from 1 to 3 feet tall. The leaves are large, long and narrow, noticeably curled or crimped at the outer margin. The flowering heads are many branched racemes. At maturity the plant changes to a dull dark brown color.

Distinguishing Characteristics—Curly dock plants are easily distinguished by large, long and narrow crimped leaves and the large many branched, dull brown flowering heads. The seed are triangular in shape, glossy, reddish brown in color, 2-3 mm long.

Cheat

Cheat is a winter annual reproducing by seed only. It is wide spread through the country where winter wheat, oats, barley and rye are grown.

Description—Cheat is similar in appearance to wheat and oats, growing erect 2-3 feet tall. The flowers and seed are borne in open panicles 5 to 10 flowers or seed in a cluster or spikelet.

Distinguishing Characteristics—The plants are similar to oats but with drooping flowering heads with many seed per spikelet. The seed may or may not bear short awns. Seed, elongated, elliptical, 3-9 mm long, with or without short awns at end of seed. The seed are light gray in color and covered with a thick glume.

COMMON WEEDS

Common Plantain

Common plantain is a perennial and reproduces by seed and new shoots from old roots. It is a common weed found in old pastures, meadows, lawns and waste places throughout the United States.

Distinguishing Characteristics—The plants have rather large oval leaves, the stems of which are usually reddish or purplish in color. The flower stalks are long and slender spikes, bearing flowers and seed almost their entire length. The seed are small (1-1.5 mm) black in color, somewhat angular or variable in shape.

Pepper Grass

Pepper grass is a winter annual, reproducing by seed only. It is common to meadows, pastures, and grain fields throughout the United States.

Distinguishing Characteristics—The plants grow erect 1 to 2 feet high and are many branched. The leaves are elongated and toothed, attached alternately on the stem. Seeds are borne in round-flattened pods and are notched at the top. The seed are ovate-flattened in shape, of a dull orange color and about 1.5 mm long.

Rough Pigweed

Rough pigweed is an annual, reproducing by seed only. It is found in gardens, cultivated fields and waste places throughout the United States.

Distinguishing Characteristics—Pigweed grows erect 2-3 feet in height. The stems are large and woody, covered with short hair. The roots are bright red in color. The leaves are oval to elongated, slightly hairy, with long leaf stems. The flowers and seed are borne in rather short thick spikes. The seed are small, 1 mm in diameter, glossy black in color and lens-shape.

Lamb's-quarter

Lamb's-quarter is an annual, reproducing by seed only. It is found in gardens, cultivated fields and waste places throughout the United States.

Distinguishing Characteristics—Lamb's-quarter is erect 2 to 3 feet in height. The stems are many branched, large and woody, smooth and angular in shape. The leaves are thick and smooth, toothed and light colored on the lower surface. The flowers are borne in spike-like clusters. The seed are small, 1 mm in diameter, lens-shaped, black and glossy but partially coated with a thin light colored paper-like covering.

DISEASES

(Edited by DR. R. F. POOLE, Professor of Plant Pathology)

POTATOES

Common Scab (*Actinomyces scabies*)

Effect on the Plant—This disease occurs only on the tuber.

Effect on the Tuber—Common scab is known to exist in any potato growing area of the United States and is undoubtedly the most common potato disease.

The scabs first appear as small reddish or brown spots on the surface of the potato. These spots enlarge and darken with age. In severe cases scab spots may spread and unite to cover the entire potato surface. The scab is in the form of a hard, brown, rounded or irregular corky mass. The scab spots vary from deep to shallow cavities or even raised forms, depending on the age of the potato when it was attacked by the disease—the earlier the potato is attacked the deeper the cavity.

Heavy applications of lime, fresh barnyard manure, and wet soils cause the disease to spread more rapidly.

Distinguishing Characteristics:

1. Common scab does not attack mature potatoes in the ground or in storage.

2. Common scab may be distinguished from powdery scab in that powdery scab produces small blisters which break through the skin, causing the skin to roll back around the border of the spot exposing brownish or dark green powder. Common scab causes rough corky spots which may be separate or run together.

3. Flea-beetle injuries sometimes resemble the external appearance of the first stages of common scab. In cutting through flea-beetle pimples or furrows, however, you will find a tough, splintery corky tissue extending perpendicular into the potato.

4. This disease may be easily distinguished from scars or cavities made by certain insects such as grubs, rodents, eelworms and wireworms in that these cavities do not contain heavy corky borders. Cavities made by grubs have rather smooth surfaces while cavities made by rodents are ridged. (No. 26).

Rhizoctonia Diseases (*Corticium vagum*)

Effect on Plant—*Rhizoctonia* is a disease (*Corticium vagum*) caused by a fungus which may attack the potato plant during any state of its growth. This disease is brought about by planting diseased potatoes or by planting potatoes in a soil that is infected with this disease.

The young potato sprouts are often attacked by this disease before they come through the soil. Small brown, sunken spots appear on the young sprouts. These spots injure the sprouts and in severe cases it may kill them.

This disease often attacks the underground stems of the plant thus causing the food and moisture supply to be cut off and small deformed potatoes may form near the surface of the ground. Stems which are badly affected but do not die may produce aerial tubers or a small number of small underground potatoes (tubers).

The root system also becomes affected thus causing many of the roots to die. The tops of the diseased potato plant turn purple or yellowish in color and roll upward but they are not brittle. The leaves have very prominent veins. The tops may also be stunted and discolored.

Under moist conditions a whitish layer of small threadlike mass forms on the stem just above the ground. This collar fungus develops from a threadlike mass (mycelium) below the surface of the ground. This is the spore stage of the fungus and it does not seem to hurt the plant.

Effect on Potatoes—Irrregular shaped dark brown or black masses of fungus threads may be found on the surface of the potato. These black patches of small fungus threads are the over-wintering or resting stage of the disease. These patches range in size from very small specks up to as much as $\frac{1}{4}$ of an inch in diameter. They look brown or grayish when they are covered with soil but upon wetting the potato they darken in color. They will not wash off. The flesh of the tuber is normal. Potatoes often become attacked by the russet scab which causes the superficial layer of the skin to die. This gives the potato a russett appearance. Rhizoctonia disease often follows cracks or injuries made by insects thus causing deep cracks to form in the potato. In some of the worst cases the potato becomes deformed. The breathing spores of the potato may also be affected by Rhizoctonia.

Distinguishing Characteristics:

1. This disease may attack the potato plant at any stage of its growth.
2. Aerial tubers may be formed.
3. The potato may be normal or it may be badly deformed.
4. The black patches on the surface of the potato cannot be washed off.
5. Flesh of tuber normal.
6. The top leaves of the plant are purple to yellowish in color, they are rolled upward but are not brittle.
7. Usually aerial or small potatoes (tubers) form at the base of the stem.
8. The sprouts of plants, which appear abnormally late have brown spots on them.

WHEAT

Scab (*Gibberella saubinetii*)

Effect on Plant—The head blight or scab and the seedling blight which occur in wheat and other small grain are caused by parasitic fungi. It is very difficult to distinguish this disease on the small seedling or plant from diseases caused by other fungi. Young plants attacked by the scab fungi usually are stunted, have a small root system and the individual rootlets turn brown or pink and oftentimes decay. Diseased plants often appear in patches in the field, killing considerable areas.

This disease is most noticeable on the head of the wheat. It usually shows up almost as soon as the heads emerge from the sheath. The diseased spikelets (separate units of the wheat head) have the appearance of ripening too early and the glumes (chaff) look pale and sickly and are white or slightly pinkish in color. The chaff or glumes are often cemented together by a pinkish, orange or reddish crust. The entire head may not

be affected but usually the part of the head above the spikelet attacked is killed, especially in a bad scab year.

Effect on the Grain—Infected plants produce a small yield of shriveled, light, rough and scabby seed, gray or whitish to a pink in color. If the head is attacked when very young, only the seed coat usually remains and is easily crushed between the fingers. If the kernel develops it has the same general shrunken and shriveled appearance as the badly infected grains.

Distinguishing Characteristics—It is a very difficult to distinguish this disease in the field. Other fungus diseases often produce similar symptoms. Only a laboratory technician can definitely establish the identity of the seedling blight or scab on the young plant.

It is rather easy, however, to recognize the symptoms of the disease both in the field and on the grain. (No. 27-28).

WHEAT

Bunt (Stinking Smut) (*Tilletia tritici* and *T. Foetani*)

Effect on the Plant—This disease is not noticeable on the plant until the heads appear. The normal or healthy wheat head dangles with yellow pollen sacks immediately after blooming. The yellow pollen sacks or anthers do not appear at all in the heads badly infected. When the wheat reaches the dough stage, infected heads turn bluish green in color, while the healthy heads remain a lighter green. The infected heads remain green longer than the healthy heads. The diseased heads remain erect while normal healthy heads of some varieties bend over slightly due to the weight of the kernels. Smutty heads are usually more slender and on lower shoots than the healthy ones.

Dark smut balls protrude between the chaff (glumes) as the grain ripens. The presence of the smut balls causes the chaff to spread enlarging the appearance of the head. The beards (awns) become more brittle and often deformed in the bearded varieties. The chaff of the diseased heads become brown and gray or white and gray when fully ripe as contrasted to the slightly golden color of healthy heads. Infected heads when mashed between the fingers will produce an oily black mass and give off a very disagreeable odor.

Effect on Threshed Grain—Stinking smut in the threshed grain may be identified by:

1. Whole or broken smut balls of a dark brown or a silvery gray color and usually somewhat like the wheat kernel. Smut balls in the grain positively indicates infestation.
2. The presence of a dark oily mass of black spores giving off a fishy odor when the kernels are pressed between the fingers. Where the grain is stored in a well ventilated place the odor is less pronounced.
3. If the wheat is heavily smutted the grains assume a darker cast due to the number of black spores adhering to the kernels. Black tipped kernels spoken of as "Tagged ends", are quite noticeable. The black on the tips is caused by smut spores collecting on the brushes on the end of the kernel.

Distinguishing Characteristics—Stinking smut may be distinguished from loose smut in the field as loose smut heads have no covering at the

time of flowering. The head becomes a naked black stem. (For methods of control see references 17 or 26 or 32 pages 6 to 13).

WHEAT

Loose Smut of Wheat (*Ustilago tritici*)

Effect on the Plant—Loose Smut of wheat is usually identified in the field by the "Blackhead." This disease is caused by fungi which lie dormant in the grain until planted and germination or growth of the plant begins. The fungi in the diseased kernels start growth in the young shoots and spread upward with the growth of the plant. The first noticeable effect of loose smut on the plant may be observed when the heads appear. The diseased heads are usually completely destroyed. The normal chaff (glumes) and kernels are replaced with black masses of smut. The greatest distribution of loose smut takes place about the time the healthy plants are in bloom. The air at this time is filled with millions of loose smut spores which come from the black smut balls of the diseased plant. The spores which settle between the chaff of the sound wheat heads germinate and produce small threads which infect the flower of the young wheat kernel inside the chaff.

Effect on Seed—The infected kernels cannot be distinguished from the disease free kernels. The smut fungus is inside the seed and the seed should be treated for loose smut before they are planted because if the diseased seed are planted without being treated these plants will be infected with smut.

Distinguishing Characteristics:

1. Loose smut matures earlier than other smuts and the smut spores are scattered by wind and water while the wheat plants are still growing.
2. Loose smut appears at the time the wheat plant is flowering as a naked fluffy black mass.
3. Loose smut spores are easily shaken off the smutted heads.
4. Loose smut heads have no covering and the smut is soon blown or washed away leaving a bare stem (rachis).

(Reference Nos. 30, 31, page 10; and 33, page 11).

WHEAT

Black Stem Rust (*Puccinia graminis*)

Effect on the Plant—Black Stem Rust is a disease caused by a parasitic fungus which robs the plant of its food thus weakening it. There are three different forms in which we may find the Black Stem Rust in the principal wheat growing states. The summer or red form develops in the early part of the summer and spreads from one grain plant to the other. The black form develops as the grain ripens and lives through the winter on the stubble and straw infecting the barberry plant in the spring producing the yellow or third form of rust. The red or first form survives mild winter and reinfests the grain plant independent of the yellow or barberry stage. There are, therefore, only two stages of this disease in the extreme southern region of the wheat growing area.

In the spring this fungus will be found on the common barberry bush where it produces cluster cups in yellowish patches on the underside of the leaf. In the summer the black stem rust will be found in the small

grain fields especially wheat. The best time to look for this disease is from the time the plant is in bloom until the soft dough stage. Masses of red or black spores will be found in blister-like spots on the stem and leaf sheath of the plant, but in badly infected plants they often occur on the leaves and chaff (glumes). These blister-like spots break the outer skin of the plant thus causing a great loss of water. Those pustules or blister-like spots vary in color from a red in early stages to black in later stages. They are filled with many red or black dust-like spores. This spore powder is very easily detached and upon walking through a severely rusted grain field ones clothes may become covered with a reddish brown dust.

Effect on grain—The infected wheat plants are robbed of their food by the rust fungus preventing the development of a normal quantity of plump grain. The grains become shriveled and of poor quality. This disease cannot be easily identified by threshed grain alone.

Distinguishing Characteristics—The Black Stem Rust develops on both the leaf and the stem of the grain plant. The leaf rusts occur only on the leaves and leaf sheaths in the form of usually very small and round spots filled with an orange yellow powdery substance, changing later in the summer to grayish black. The spots developed by the Black Stem Rust are long and filled with a brick red powder, or spores, changing later in the summer to a black powder. The skin of the grain plant curls back from the rust spot due to the weakening of the tissues. The Black Stem Rust requires the common barberry bush as a host plant except in the southern region while other rusts do not. (No. 34-35—See page 13, reference No. 34 for additional help).

WHEAT

Leaf Rust (*Puccinia triticina*)

Effect on Plant—Leaf rust is a common disease of wheat which is caused by a parasitic fungus that attacks the leaves and leaf sheaths of the growing wheat plant. The rust spores, which live over the winter, germinate in the spring under favorable conditions and produce thousands of spores which may be carried by the wind. If any of these spores come in contact with the leaves or leaf sheaths of the growing plant, they germinate and produce the disease.

Leaf rust can be easily identified in the field in that this disease causes small round spots to form on the leaves and leaf sheaths of the plant. These spots are usually round, and they do not break the surface of the leaf. Early in the season these spots appear yellowish because they are filled with an orange yellow powdery substance but as they grow older they turn darker and by the time they are mature they appear grayish black. The diseased plants may be stunted or they may be of normal size, depending upon what age the plant becomes infested. The diseased plants show signs of ripening sooner than the normal disease-free plants, also the heads of the diseased plants may be shorter and not filled out as well as the normal heads.

Effect on Grain—The grain may be greatly damaged by this disease or the damage may not be noticeable depending upon the age of the plant when it becomes diseased. Usually the diseased plants produce a smaller yield and the kernels are light and shrivelly. The protein content of the

grain is decreased. The starch content varies inversely with the protein content, however, because of the smaller number and size of the kernels, the total quantity of starch per head is greatly reduced by leaf rust. Leaf rust cannot be identified by the grain.

Distinguishing Characteristics—Leaf rust can be easily distinguished from black stem rust by the size, shape, and color of the spores that are produced. Leaf rust only attacks the leaves and leaf sheaths of the plant whereas black stem rust may attack the leaves, leaf sheaths or the stem of the plant. The spots or spores formed by leaf rust are usually round and very small and they do not break the outer surface of the leaf. The spots formed in Black Stem Rust are usually oblong and larger than those of leaf rust. These spots break the outer skin of the leaf or stem of the plant. In the first stages of leaf rust the spores are of an orange color whereas in the stem rust they are of a reddish color. Leaf rust does not require a host in order to reproduce. In cold climates black stem rust requires a host, in order to carry on its life cycle.

WHEAT

Nematode or Eelworm—(*Tylenchus tritici*)

Effect on Plant—Nematode or eelworm is a disease of wheat which may occur on any part of the growing plant but it usually produces a more noticeable effect in the wheat head as it causes galls to form instead of kernels. The galls contain thousands of living but motionless young nematodes called larvae. The larvae escape from the galls that fall to the ground or the ones planted along with the wheat seed and with eel-like movement they finally reach the young seedling. There they usually become located between the leaf sheaths close to the bud and are carried upward as the plant grows. When the plant blooms they enter the flower and after laying many eggs they die. These eggs give rise to larvae which quickly change into the second-stage larvae and remain in this condition for several years.

Although this disease may be found on any part of the plant above the ground it is most frequently found to attack the wheat head. Young seedlings that become heavily attacked are often killed. In plants that are badly diseased the leaves may be twisted and rolled up often enclosing the tip of the leaf. The new leaves that are formed may be held by the older ones and they may become deformed. The plants may be diseased but still not show any signs of being diseased until the heads are formed. This disease causes galls to form in the head instead of the kernels. The diseased heads are smaller, shorter and remain greener longer than normal heads. The chaff or glumes are open wider and the galls can often be seen in the diseased heads before threshing the grain. The galls are darker and a little shorter and wider than the wheat kernels. They contain many living but motionless young nematodes or larvae. The larvae are very small and when placed in water they appear as short threadlike fibers.

Effect on Grain—There is not any sign of the disease on the wheat seed that are produced. This disease greatly reduces the yield of grain because the flowers that are attacked by the larvae do not produce a wheat kernel.

Distinguishing Characteristics

1. Galls formed by nematode disease can be distinguished from bin-burnt kernels, cockle seed, and the spores formed by burnt or stinking smut in that these galls are filled with larvae and when these larvae are placed in water they appear as small short threadlike fibers.
2. The larvae or young nematode enters the plant from the ground and is carried upward as the plant grows.
3. This disease causes galls to form in the place of wheat kernels.
4. The larvae in the galls are living but motionless. (No. 37).

CORN

Smut—(*Ustilago zeae*)

Effect on Plant—Corn smut is a common disease of corn. This disease is caused by a parasitic fungus, (*Ustilago zeae*), which may attack any part of the corn plant above the ground during any stage of its growth. The smut spores, which live over the winter, germinate in the spring, under favorable conditions, and produce many small spores, which may be carried by the wind. If any of these spores come in contact with any part of the growing plant they may germinate and produce the disease.

This disease can be easily identified in the field because of the formation of smut balls. The smut spores which come in contact with the growing corn plant germinate and cause a swelling of the tissues of that part of the plant. At first these spots, enlargements or smut balls appear whitish or light grey in color due to the white skin or membrane surrounding them, but they turn darker with age and by the time they are mature they appear as black masses on the corn plant. When fully mature the outer skin or membrane breaks and thousands of small, black, dust-like spores are set free.

Smut balls vary in size from an inch to several inches in diameter depending on what part of the plant they are formed. The smut balls which are formed in the tassel and on the leaves are much smaller than those formed on the other parts of the plant. The tip of the ears of corn are often affected by this disease and in some cases the smut ball may entirely replace the ear of corn and be nearly surrounded by the shuck or husk which may be diseased. Corn plants which become diseased before they are over one foot high are usually killed or stunted in growth. Young plants becoming diseased below where the ear should form often cause barrenness.

Effect on Grain—There is no visible effect on the grain unless the smut attacks the ear of corn. In some cases where only the end of the ear becomes infected the smutted end can be broken off and the rest of the ear can be used. Oftentimes when the ear becomes smutted the entire ear is destroyed.

Distinguishing Characteristics—Most any farm boy should easily identify this disease on sight. The chief characteristic is the formation of large smut balls which contain thousands of black spores.

This disease may attack any part of the growing plant during any stage of its development.

The smut balls vary in size from an inch to several inches in diameter, depending on what part of the plant they are found.

OATS

Loose Smut—(*Ustilaga avenae*)

Effect on Plant—Loose smut of oats is usually identified in the field by dark brown or black smutty heads. This disease is caused by a parasitic fungus which lives in or on the oat plant. The smut fungus which is attached to the seed coat of the grain remains in a dormant or resting stage until the seed are planted and germination or growth of the plant begins. The smut fungus germinate about the same time and grows in the tissue of the plant where it continues to grow upward as the plant increases in height. The first noticeable effect of loose smut on the plant may be observed when the heads appear. As the young flowers begin to form, the smut fungus begins rapid growth and may completely destroy and replace the flower part with dark brown or black masses of smut. The greatest distribution of loose smut takes place about the time the healthy heads are in bloom, and are open for pollination. The air at this time is filled with millions of loose smut spores, which come from the dark brown or black masses on the infested plants. When these spores enter the flower and come in contact with the developing oat seed they germinate and attach themselves to the seed oat and the scale covering the grain.

Loose smut spores are easily shaken off the smutted head and the smut is soon blown or washed away leaving a naked stem (rachis).

Effect on Grain—The infested seed are not different in appearance and cannot be distinguished from the disease-free seed.

Distinguishing Characteristics—Loose smut appears about the time the healthy plants are in bloom. After the disease reaches its final smut stage the spores forming a black mass on the head are blown or washed off leaving a naked stem (rachis). (No. 29).

BARLEY

Stripe—(*Helminthosporium gramineum*)

Effect on Plant—Barley Stripe is a disease which may be easily identified in the field. The diseased plants are usually stunted in growth. This disease causes long, yellowish brown stripes to form on the leaves shortly before heading time. Later on, these leaves may split along these stripes and give the leaves a shredded appearance. The heads are usually shorter as they do not emerge fully from the plant. They are discolored and shrunk and seldom produce any sound kernels. The diseased plants die and are hard to find by harvest time.

Effect on Grain—This disease greatly reduces the yield of barley. The diseased plant seldom produces any sound grain. Not identified by grain alone.

Distinguishing Characteristics.

1. This disease causes yellowish brown stripes to form on the leaves.
2. The leaves may split along these stripes and give the leaves a shredded appearance.
3. Diseased plants seldom produce any sound grain.
4. By harvest time the diseased plants are dead and are hard to find.

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- D. Farm Weeds—Dominion of Canada, Department of Agriculture. For sale by single copies only by the Superintendent of Stationery, Government Printing Bureau, Ottawa. Price \$2.00. Illustrated in colors—very valuable reference.
- E. Classification of wheat varieties grown in the United States, by J. Allen Clark and B. B. Bayles—U. S. D. A. Technical Bulletin No. 459—order at once.
- F. See literature cited on next page.

Source of Seeds for Laboratory

Standard seed supplies for use in laboratory practice may be secured from the Agronomy Department, North Carolina State College, at cost, provided arrangements are made in time for these materials to be put up and delivered. Write J. B. Cotner, Professor of Agronomy, North Carolina State College, Raleigh, for information about cost and supplies several months prior to the time you will need them for school use. Teachers should arrange orders by county groups.

Equipment for Identification of Both Plants and Seeds

Tri-pod magnifier, price 50¢ to 60¢ depending on size of order from Central Scientific Company, Chicago, or other companies.

Glass capsule vial No. 3 with clamp cap—for sale by the King Drug Company, Raleigh, North Carolina, at 3½¢ each, or \$4.65 a gross. This capsule is about two inches high and one inch in diameter and the type used by the Agronomy Department. Seeds stored away from the light in these capsules with a piece of moth ball about the size of a grain of wheat will keep for several years. Your local drug company might have these in stock—insist on the clamp cap and No. 3 size.

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HELPS ON SHARPENING HAND WOODWORKING TOOLS



DEPARTMENT OF EDUCATION
NORTH CAROLINA STATE COLLEGE OF AGRICULTURE AND ENGINEERING
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THE UNIVERSITY OF NORTH CAROLINA
STATE COLLEGE STATION
RALEIGH, N. C.

FOREWORD

These helps were prepared by members of the staff of the Department of Agricultural Engineering and the Department of Agricultural Education of the North Carolina State College for the purpose of assisting teachers and students in vocational agriculture and any others interested in the improvement of shop programs.

It is a well appreciated fact that the use of well cared for shop tools has a far reaching influence on the student and enables him to do the job in hand well. There are educational values that carry over into all activities of life. For that reason we consider it highly essential that the simple fundamental methods of sharpening and caring for hand woodworking tools should occupy an important place in the program of shop work in North Carolina.

We hope the teachers of vocational agriculture and shop work will make ample use of this series of helps in order that our whole shop program may be improved.

T. E. BROWNE, *Director*
Department of Education.

PURPOSE

It is not only the teaching of skills, but the guiding of the boy to the place where he experiences satisfaction in the performance of a job well done, that encourages him to progress in his work. Any experienced mechanic will tell you there is no satisfaction to be had from the use of a dull tool.

This bulletin on methods of sharpening hand woodworking tools has been prepared primarily for the use of teachers and students of vocational agriculture. Each page gives step by step illustrations and directions on methods of sharpening one particular tool. While the directions and illustrations are, we hope, very clear the teacher should not assume that they are to take the place of his demonstration and other instruction.

Probably one of the weakest phases of farm shop instruction is the failure of the teacher to "set" the situation so the student may gain an insight or understanding of what he is to do before he begins the practice. Very few farm boys know how properly to sharpen the common woodworking tools used on their farms. It is hoped that this series of helps will greatly strengthen both the students' appreciation and practice in this phase of our farm shop program.

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Grinding Plane Irons.....	4
Grinding Wood Chisel.....	5
Whetting Plane Iron and Wood Chisel.....	6
Cutting Hand Rip Saw Teeth.....	7
Cutting Hand Crosscut Saw Teeth.....	8
Sharpening Hand Rip Saws.....	9
Sharpening Hand Crosscut Saws.....	10
Sharpening Auger Bits.....	11
Sharpening Knives.....	12
Sharpening Axe and Hatchet.....	13
Sharpening Cabinet Scraper.....	14
Grinding Screw Driver.....	15

FARM SHOP SERIES

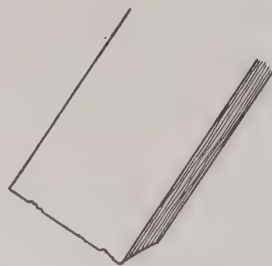
No. A-1

GRINDING PLANE IRONS

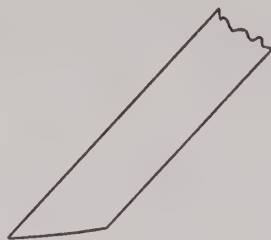
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GRIND:

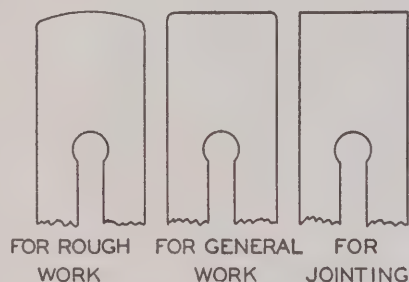
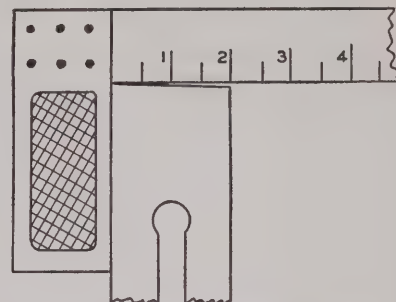
① WHEN EDGE IS NICKED,—



② WHEN CONCAVE BEVEL HAS BEEN REMOVED BY WHETTING,—

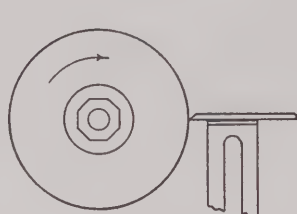
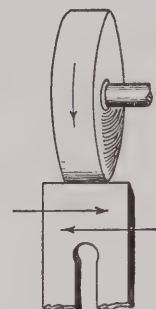
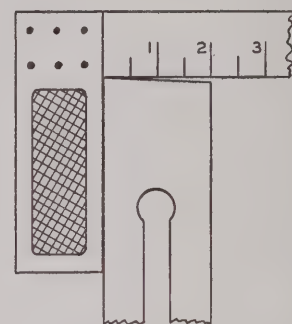
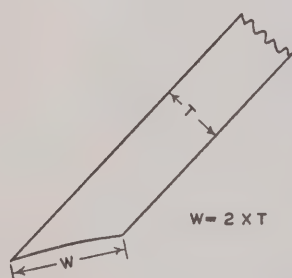
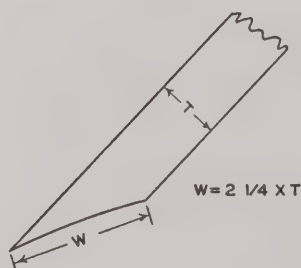
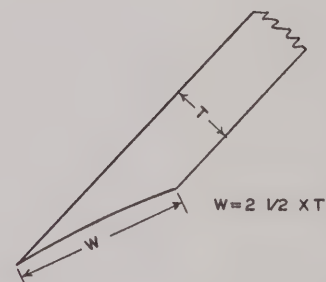
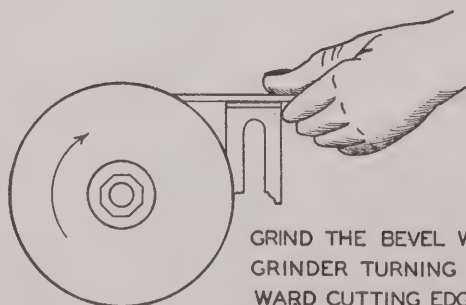
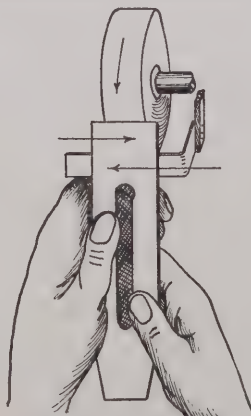


③ WHEN EDGE IS NOT SQUARE.



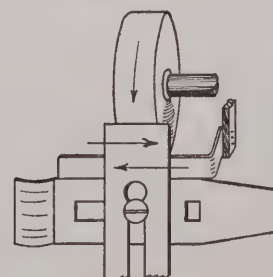
SHAPE OF CUTTING EDGE

④

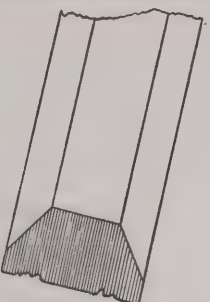
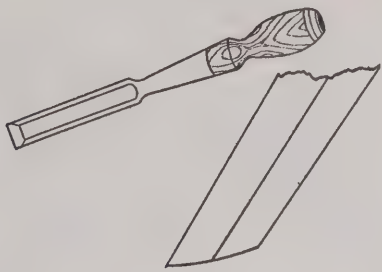
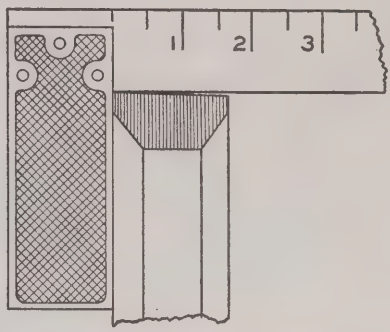
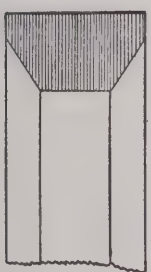
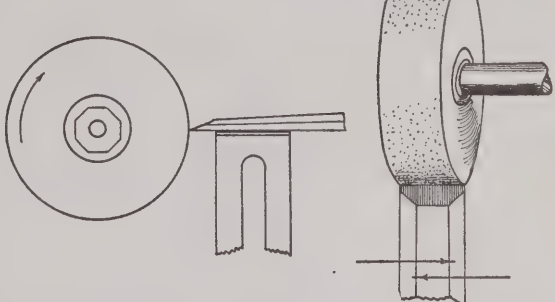
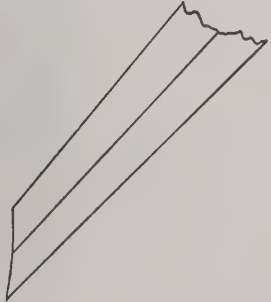
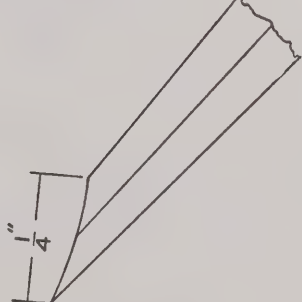
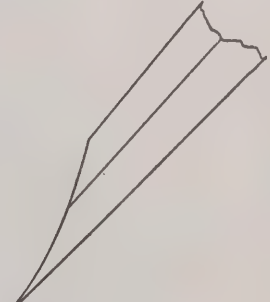
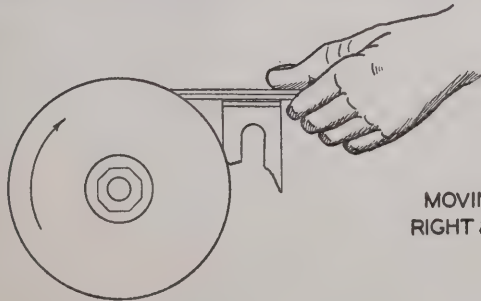
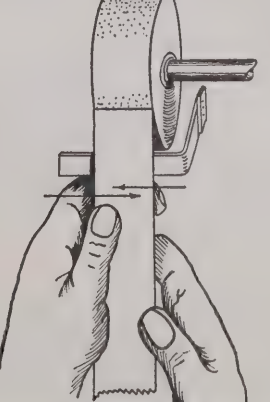
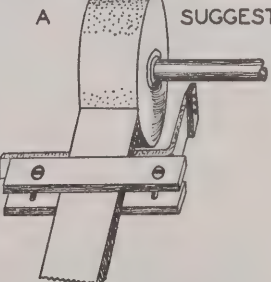
⑤ FOR JOINTING:
PLACE IRON AT LEVEL
OF CENTER OF STONE,—MOVE IRON
RIGHT & LEFT,—TEST EDGE FREQUENTLY
FOR SQUARENESS.⑥ USE BLUNT BEVEL FOR VERY
HARD WOOD,—⑦ MEDIUM BEVEL FOR MOST
WOODS,—⑧ AND A LONG BEVEL FOR VERY
SOFT WOOD.GRIND THE BEVEL WITH
GRINDER TURNING TO-
WARD CUTTING EDGE BY
MOVING IRON RIGHT &
LEFT.

⑨

A SUGGESTION

USE PLANE IRON CAP
AS GUIDE.

⑩

FARM SHOP SERIES NO A-2	<h1>GRINDING WOOD CHISEL</h1>		Dept. Agri. Engineering Dept. Agri. Education N.C. STATE COLLEGE
 <p>GRIND: ① WHEN EDGE IS NICKED,—</p>	 <p>② WHEN CONCAVE BEVEL HAS BEEN REMOVED BY WHETTING—</p>	 <p>③ WHEN EDGE IS NOT SQUARE.</p>	
 <p>④ SHAPE CUTTING EDGE THUS:</p>	 <p>⑤ PLACE IRON AT LEVEL OF CENTER OF STONE, MOVE IRON RIGHT & LEFT, TEST EDGE FREQUENTLY FOR SQUARENESS.</p>		
 <p>⑥ USE: BLUNT BEVEL FOR MORTISING</p>	 <p>⑦ MEDIUM BEVEL FOR GENERAL WORK</p>	 <p>⑧ AND A LONG BEVEL FOR FINE PARING WORK</p>	
 <p>GRIND THE BEVEL WITH GRINDER TURNING TOWARD CUTTING EDGE —</p>  <p>MOVING IRON RIGHT & LEFT</p>		 <p>A SUGGESTION LIGHT STRAP IRON OR HEAVY GALVANIZED IRON</p>	

FARM SHOP SERIES

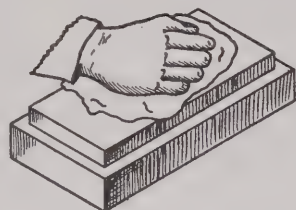
NO. A-3

WHETTING PLANE IRON AND WOOD CHISEL

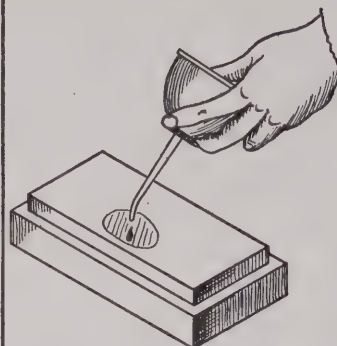
 Dept. Agri. Engineering
 Dept. Agri. Education
 N.C. STATE COLLEGE

WHET

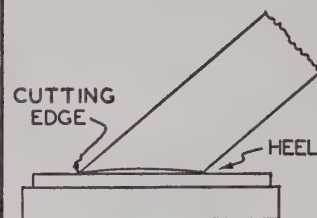
AFTER GRINDING,
WHEN DULL BUT
DOES NOT
REQUIRE GRINDING.



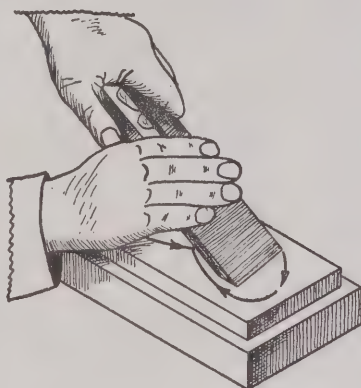
CLEAN OILSTONE
THOROUGHLY WITH
RAG.



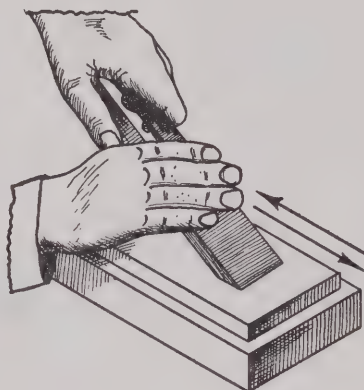
APPLY CLEAN LIGHT
OIL TO STONE.



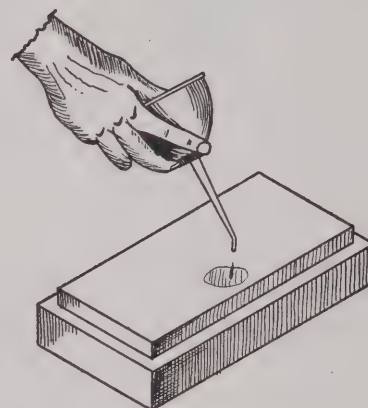
PLACE IRON ON STONE
KEEPING CUTTING
EDGE IN CONTACT.
HEEL LIGHTLY IN
CONTACT OR
SLIGHTLY RAISED.



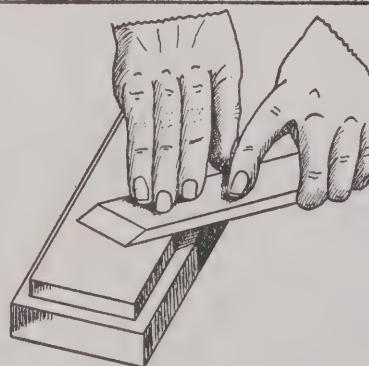
WHET WITH CIRCULAR
MOTION—



OR WITH BACK AND FORTH
MOTION.

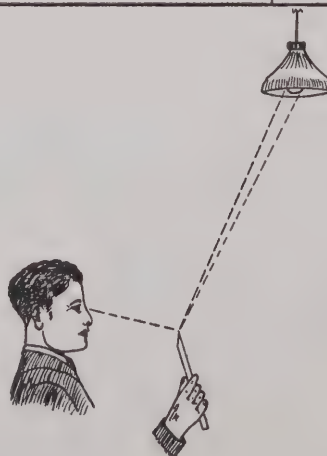


ADD FRESH OIL AS NEEDED.

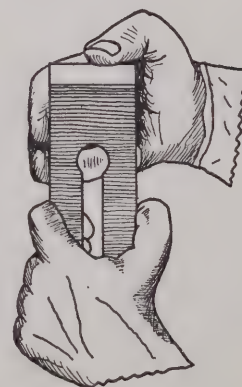


BEGIN REMOVAL OF
WIRE EDGE WITH
UNBEVELED SIDE
FLAT ON STONE.

REPEAT
OPERATIONS
SHOWN
IN
FIGURES
5 AND 8.



UNTIL EDGE DOES NOT
REFLECT LIGHT —



OR UNTIL EDGE FEELS
SMOOTH AND KEEN
UNDER THUMB TEST.

FARM SHOP SERIES
NO. A-4

CUTTING HAND RIP SAW TEETH

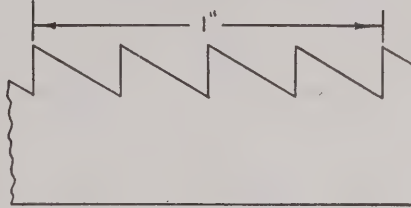
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N.C. STATE COLLEGE

WHEN HANDSAW TEETH HAVE BEEN BROKEN OFF GRIND DOWN TO BASE OF TEETH AND CUT NEW TEETH.

SUGGESTION: — BEFORE WORKING ON A GOOD SAW PRACTICE ON AN OLD SAW BLADE OR PIECE OF 12 GAUGE SHEET METAL.

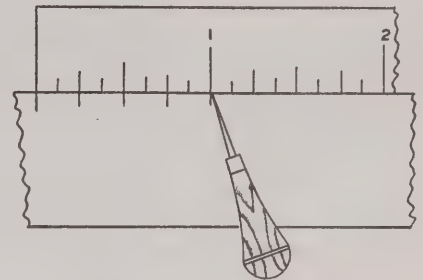
①

5 POINTS PER INCH
4 TEETH PER INCH



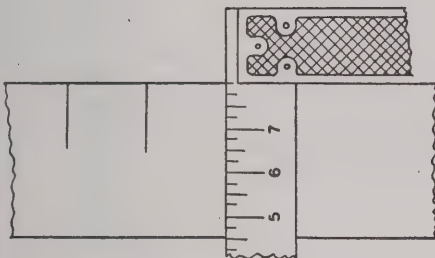
SELECT NUMBER OF POINTS PER INCH WANTED.

②



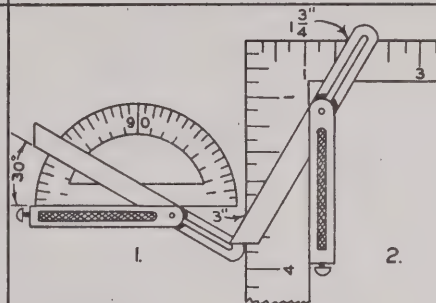
SPACE THE TEETH ACCURATELY.

③



LAY OFF FRONT OF TEETH ON BOTH SIDES.

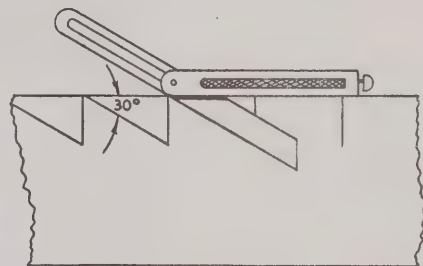
④



SET T-BEVEL FOR 30°

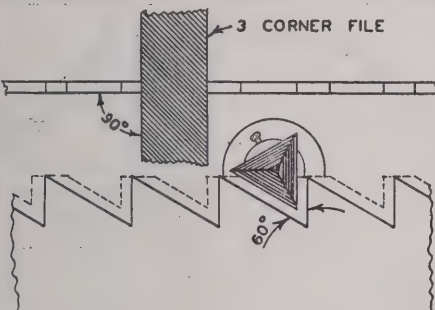
1. BY USE OF PROTRACTOR
2. BY USE OF FRAMING SQUARE.

⑤



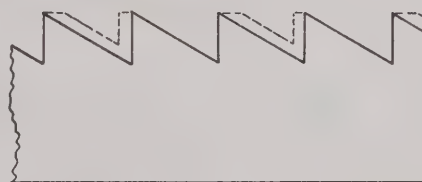
LAY OFF BACK OF TEETH ON BOTH SIDES.

⑥



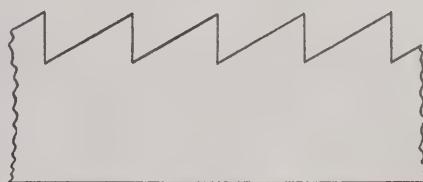
REMOVE $\frac{3}{4}$ OF METAL BETWEEN MARKS FILING FROM ONE SIDE.

⑦



REMOVE ACCURATELY REMAINDER OF METAL FROM EVERY OTHER GULLET FILING FROM ONE SIDE.

⑧

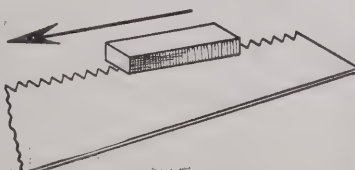


REVERSE BLADE IN VISE AND REMOVE REMAINING METAL. BRING TEETH TO SHARP POINT AT TOP LINE.

⑨

RETOUCH WITH LIGHT STROKES TO PRODUCE KEENNESS.

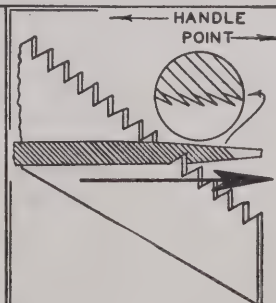
⑩



REMOVE WIRE EDGE BY MAKING LIGHT STROKES WITH AN OILSTONE OR MILLFILE TOWARD

HANDLE OF SAW.

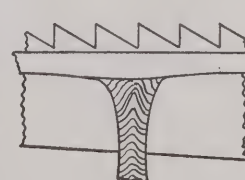
⑪



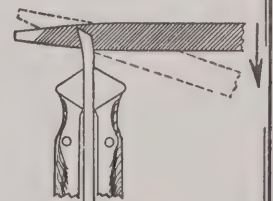
A FILE CUTS IN ONE DIRECTION ONLY—FORWARD.

⑫

SUGGESTIONS



TO PREVENT SCREECHING, CLAMP BLADE IN VISE JAWS AS CLOSE TO BASE OF TEETH AS POSSIBLE.



IF NECESSARY DROP FILE HANDLE SLIGHTLY.

FARM SHOP SERIES
NO. A-5

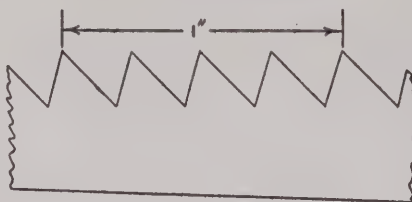
CUTTING HAND CROSSCUT SAW TEETH

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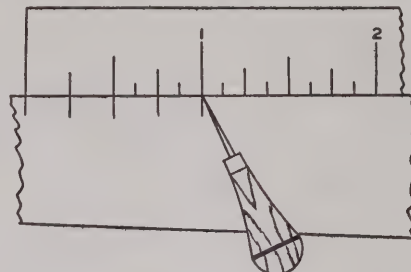
WHEN HANDSAW TEETH HAVE BEEN BROKEN OFF GRIND DOWN TO BASE OF TEETH AND CUT NEW TEETH.

SUGGESTION: — BEFORE WORKING ON A GOOD SAW PRACTICE ON AN OLD SAW BLADE OR PIECE OF 12 GAUGE SHEET METAL.

5 POINTS PER INCH
4 TEETH PER INCH



SELECT NUMBER OF POINTS
PER INCH WANTED.

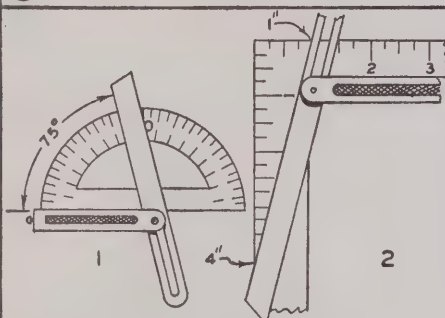


SPACE THE TEETH
ACCURATELY.

①

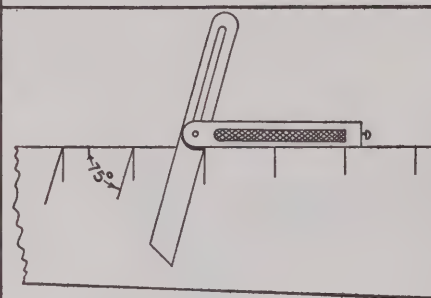
②

③



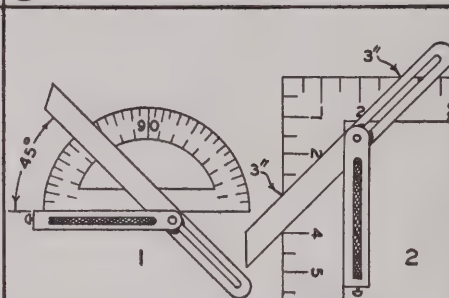
SET T-BEVEL FOR 75°
1. BY USE OF PROTRACTOR
2. BY USE OF FRAMING SQUARE.

④



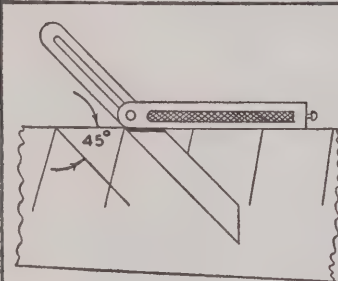
LAY OFF FRONT OF
TEETH ON BOTH SIDES.

⑤



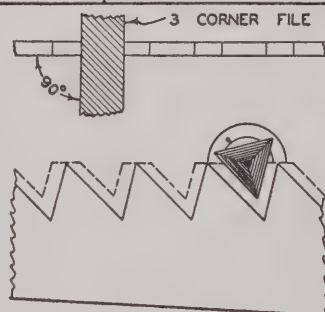
SET T-BEVEL FOR 45°
1. BY USE OF PROTRACTOR
2. BY USE OF FRAMING SQUARE.

⑥



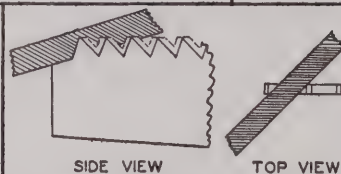
LAY OFF BACK OF
TEETH ON BOTH SIDES.

⑦



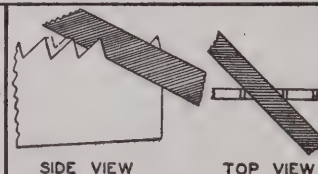
REMOVE $\frac{3}{4}$ OF METAL
BETWEEN MARKS FILING
FROM ONE SIDE.

⑧



1. PLACE SAW IN VISE WITH
POINT TO LEFT.
2. PLACE FILE IN FIRST
GULLET FROM LEFT.
3. SWING FILE HANDLE
45° TO LEFT.
4. FILE EVERY OTHER
TOOTH TO POINT
AT TOP LINE.

⑨

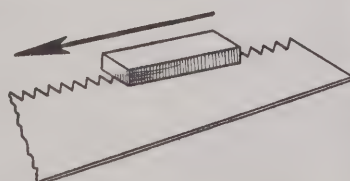


1. REVERSE SAW IN VISE
POINT TO RIGHT.
2. PLACE FILE IN SEC-
OND GULLET FROM
RIGHT END.
3. SWING FILE HANDLE
45° TO RIGHT.
4. FILE EVERY OTHER
TOOTH TO POINT
AT TOP LINE.

⑩

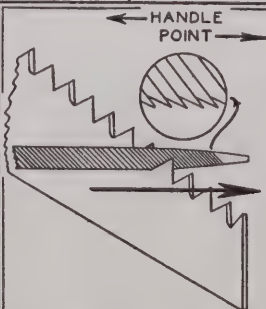
RETOUCH
WITH LIGHT
STROKES
TO
PRODUCE
KEENNESS.

⑪



REMOVE WIRE EDGE BY
MAKING LIGHT STROKES
WITH AN OILSTONE OR
MILLFILE TOWARD
HANDLE OF SAW.

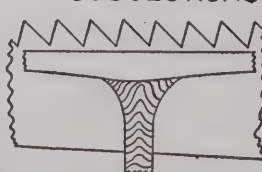
⑫



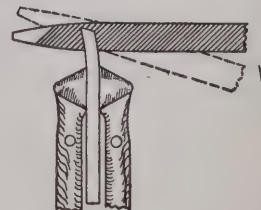
A FILE CUTS IN
ONE DIRECTION
ONLY — FORWARD.

⑬

SUGGESTIONS



TO PREVENT
SCREECHING, CLAMP
BLADE IN VISE
JAWS AS CLOSE TO
BASE OF TEETH
AS POSSIBLE.

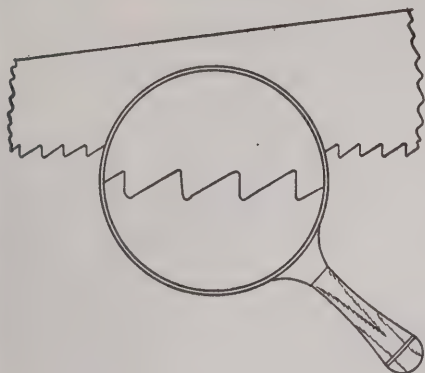


IF NECESSARY
DROP FILE
HANDLE SLIGHTLY.

FARM SHOP SERIES

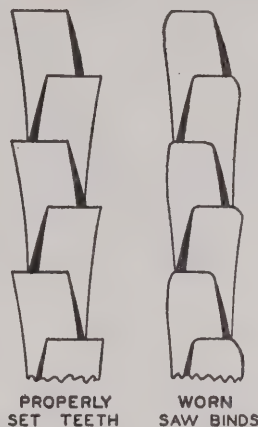
NO. A-6

SHARPENING HAND SAWS

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SHARPEN WHEN TEETH ARE
DULL IRREGULAR IN SHAPE
OR—

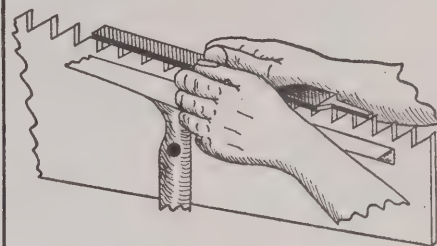
①



PROPERLY
SET TEETH WORN
SAW BINDS

WHEN "SET" IS WORN.

②

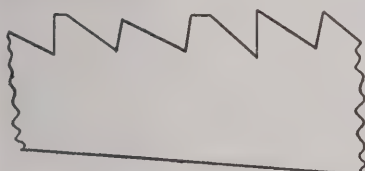


JOINTING

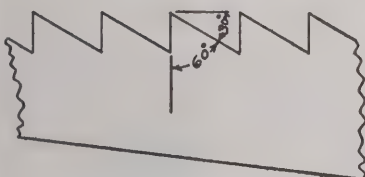


TOP JOINT WITH FLAT FILE
UNTIL SHORTEST TEETH ARE
LIGHTLY TOUCHED.

③



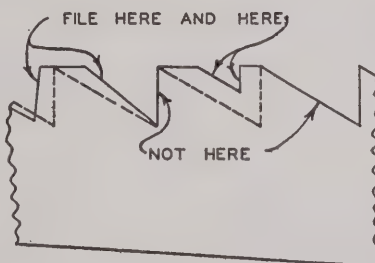
SHAPING NEEDED



SHAPING NOT NECESSARY

SHAPE IF NECESSARY.

④



FILE HERE AND HERE

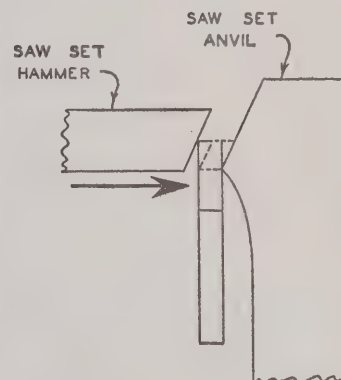
NOT HERE

SHAPE BY FILING FROM
ONE SIDE AT RIGHT
ANGLE TO BLADE.

⑤

RETOUCH
WITH LIGHT
STROKES
TO
PRODUCE
KEENNESS.

⑥



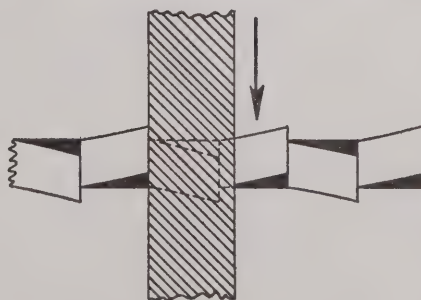
BEND UPPER $\frac{1}{3}$ TO $\frac{1}{2}$
OF EACH TOOTH WITH
SAW SET.

⑦



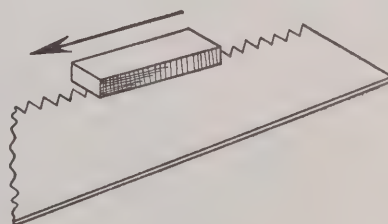
SET EVERY OTHER TOOTH TO
THE RIGHT—
REMAINDER TO THE LEFT.

⑧



POINT TEETH BY LIGHTLY
STROKING EVERY OTHER TOOTH
REVERSE SAW AND POINT
REMAINING TEETH.

⑨



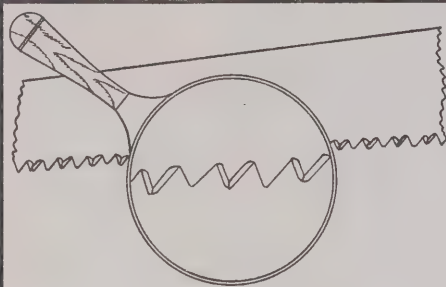
REMOVE WIRE EDGE BY
MAKING LIGHT STROKES
WITH AN OILSTONE OR
MILLFILE TOWARD
HANDLE OF SAW.

⑩

FARM SHOP SERIES
NO. A-7

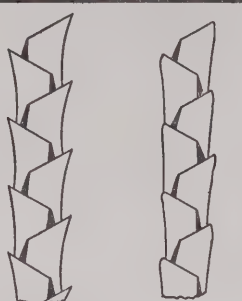
SHARPENING HAND CROSSCUT SAWS

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Dept. Agri. Education
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SHARPEN WHEN TEETH
ARE DULL IRREGULAR IN
SHAPE OR—

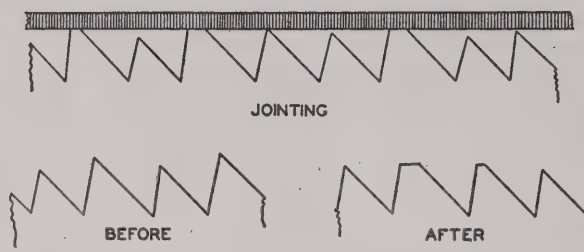
①



PROPERLY SET. WORN SAW BINDS

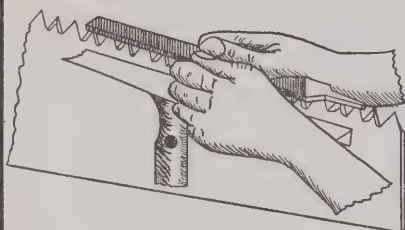
—WHEN SET IS
WORN.

②



TOP JOINT WITH FLAT FILE UNTIL
SHORTEST TEETH ARE LIGHTLY
TOUCHED BY—

③



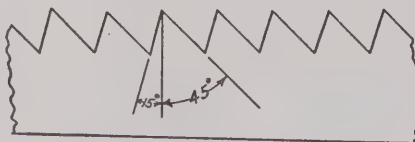
JOINTING

—HOLDING FILE THUS

④



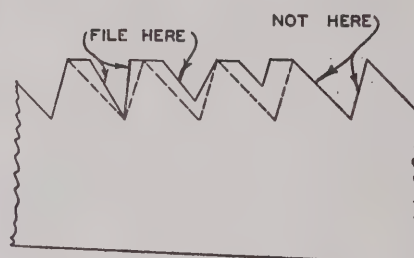
SHAPING NEEDED



SHAPING NOT NECESSARY

SHAPE IF NECESSARY.

⑤

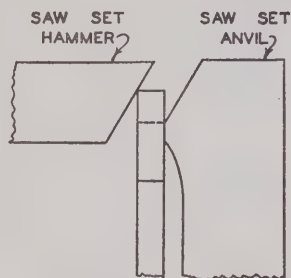


SHAPE BY FILING FROM
ONE SIDE AT RIGHT
ANGLE TO BLADE.

⑥

REPEAT
TOP
JOINTING
AND
SHAPING
UNTIL ALL
TEETH ARE
UNIFORM.

⑦



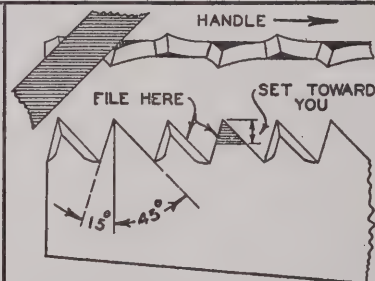
BEND UPPER $\frac{1}{3}$ TO $\frac{1}{2}$
OF EACH TOOTH WITH
SAW SET.

⑧



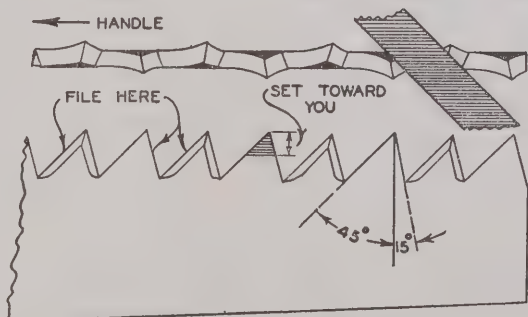
SET EVERY OTHER TOOTH.
REVERSE THE SAW AND
SET REMAINDER.

⑨



PLACE FILE 45° IN GULLET
TO LEFT OF FIRST TOOTH
SET TOWARD YOU. FILE
EVERY OTHER GULLET.

⑩



REVERSE SAW.

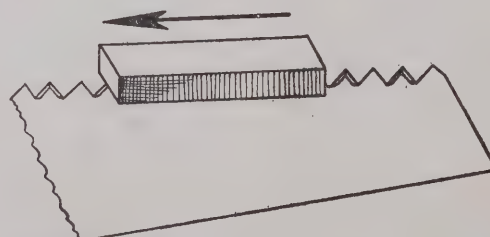
FILE REMAINING GULLETS AT 45°

⑪

NOTE:

FILE MUST
POINT
TOWARD
HANDLE OF
SAW.

⑫



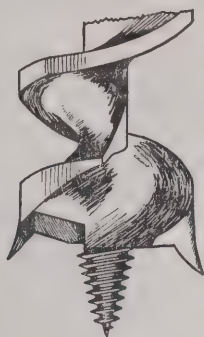
REMOVE WIRE EDGE BY MAKING LIGHT
STROKES WITH AN OILSTONE OR
MILLFILE TOWARD HANDLE OF SAW.

⑬

FARM SHOP SERIES

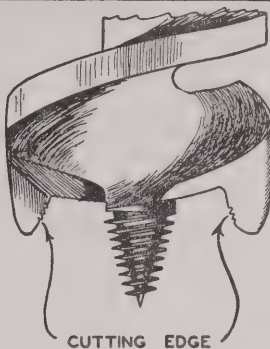
No. A-8

SHARPENING AUGER BITS

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Dept. Agri. Education
N.C. STATE COLLEGE

SHARPEN WHEN SPURS ARE BENT—

①

WHEN SPURS ARE
DULL OR NICKED—

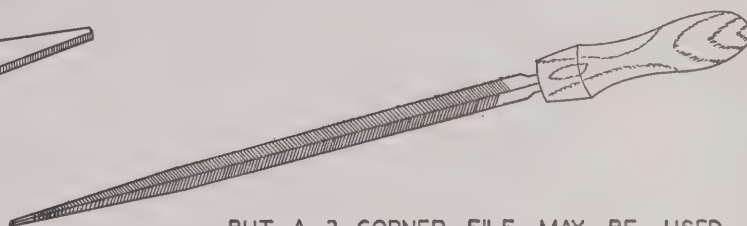
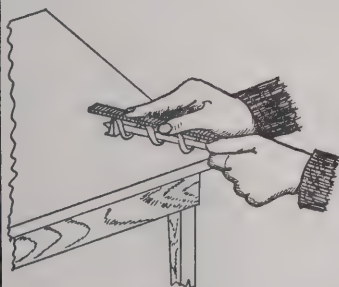
②

OR WHEN CUTTING LIPS
ARE DULL OR NICKED.

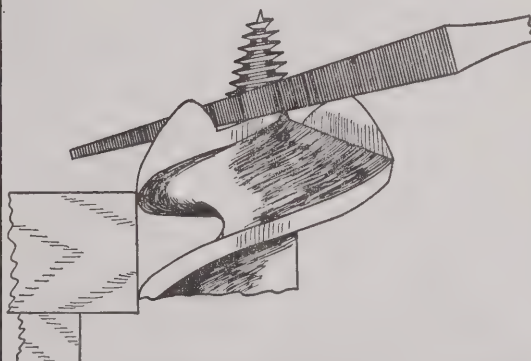
③

AUGER BIT FILE SHOULD BE USED
ON ALL SIZE BITS—

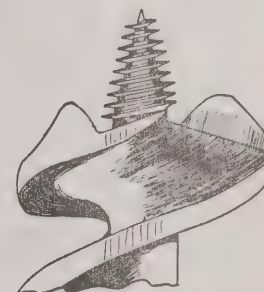
④

BUT A 3 CORNER FILE MAY BE USED
ON LARGER BITS.IF SPURS ARE BENT OUTWARD
FILE LIGHTLY WITH FLAT FILE
UNTIL DIAMETER AND SPURS ARE
EQUAL. KEEP FILE FLAT.

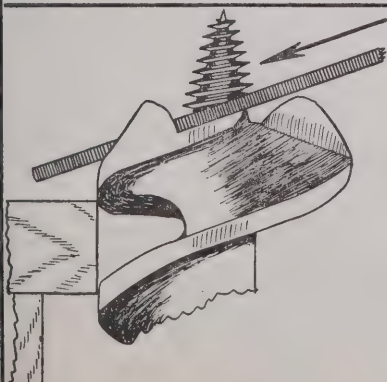
⑤

FILE CUTTING EDGE OF SPURS ON INSIDE.
FILE TOWARD CUTTING EDGE.

⑥

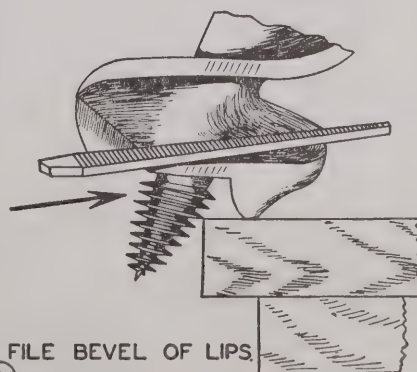
NOTE— CUTTING EDGE OF
LIP SHAPED LIKE A CHISEL—
ONE SIDE FLAT ONE SIDE
BEVELED.

⑦



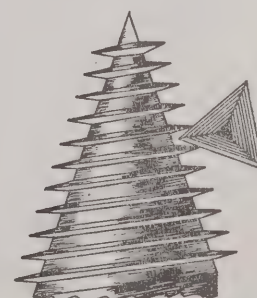
FILE FLAT SIDE OF LIPS.

⑧



FILE BEVEL OF LIPS.

⑨

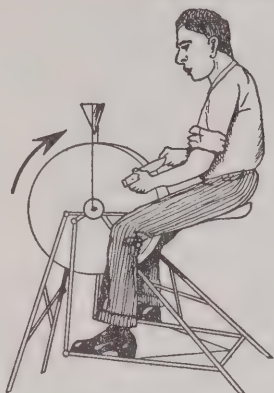
RUN 3 CORNERED FILE
AROUND THREADS OF FEED
SCREW IF DAMAGED.

⑩

FARM SHOP SERIES
NO. A-9

SHARPENING KNIVES

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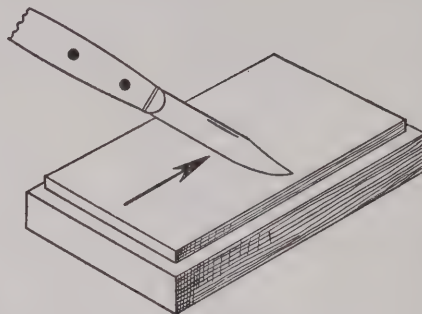
① GRIND ON WATER STONE.



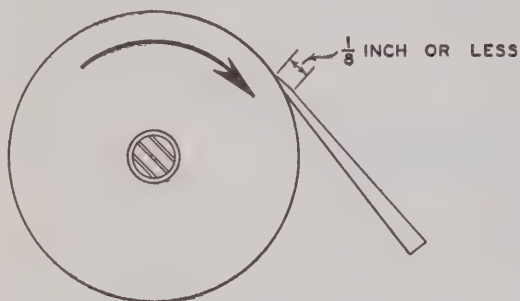
WHEN NICKED



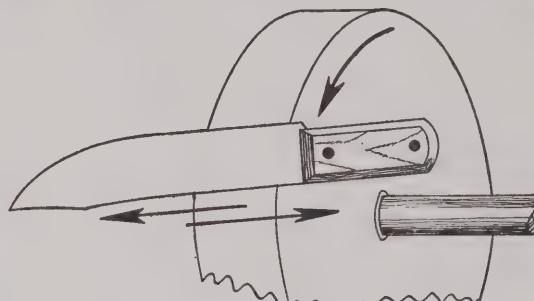
② OR VERY DULL.



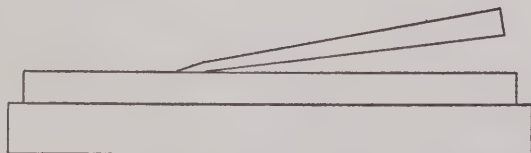
③ WHET ON OILSTONE WHEN SLIGHTLY DULL AND AFTER GRINDING.



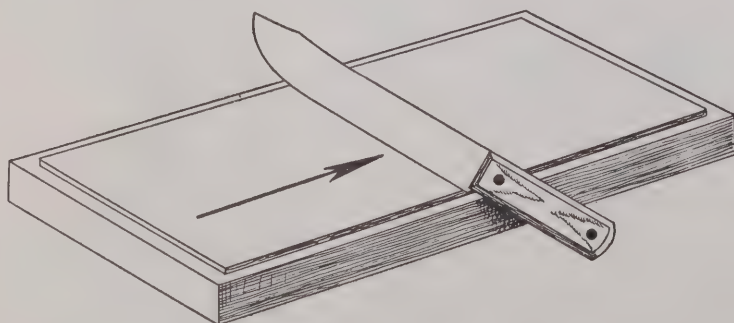
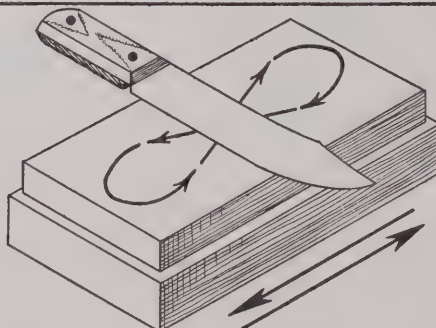
④ GRIND A CONVEX OR STRAIGHT BEVEL ON BOTH SIDES, GRINDER TURNING TOWARD CUTTING EDGE.



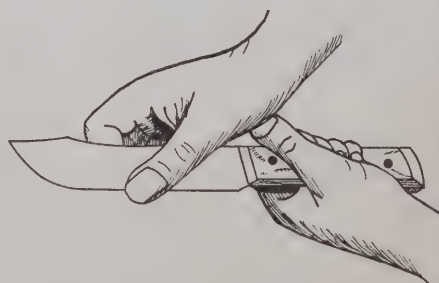
MOVE BLADE BACK AND FORTH ACROSS FACE OF STONE.



⑤ WHET WITH CIRCULAR OR BACK AND FORTH MOTION. USE ENTIRE SURFACE OF STONE.



⑥ FOR A KEEN EDGE STROP ON LEATHER.

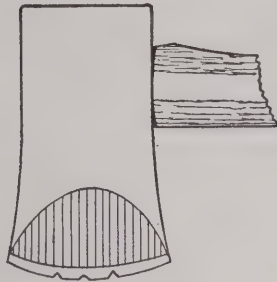


⑦ WHEN SHARP EDGE FEELS SMOOTH AND KEEN UNDER THUMB TEST.

FARM SHOP SERIES

No. A-10

SHARPENING AXE AND HATCHET

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 Dept. Agri. Engineering
 N.C. STATE COLLEGE


JOINT:

WHEN BADLY NICKED—

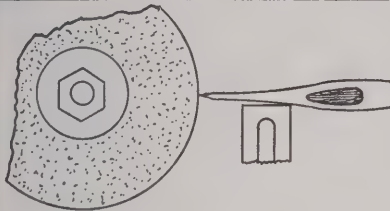
①



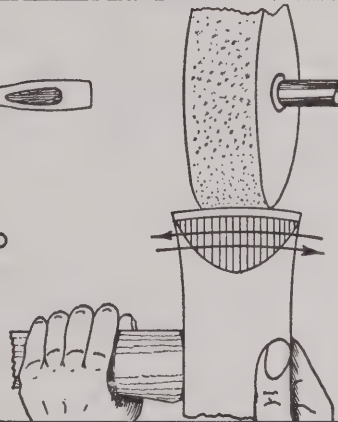
CORRECT

OR WHEN NOT CORRECTLY HUNG

②

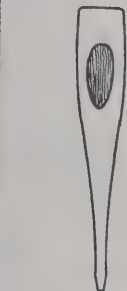

 JOINT BY PLACING HEAD
 AT LEVEL OF CENTER
 OF STONE

③



④

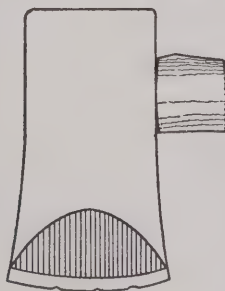
GRIND OR FILE BLADE
TO FAN SHAPE
 A THIN BLADE
 FOR CLEAN
 CUTTING &
 THE SOFTER
 ⑤ WOODS

 A THICK BLADE
 FOR SPLITTING,
 ROUGH WORK &
 EXTRA HARD
 WOODS


GRIND THE BEVEL:

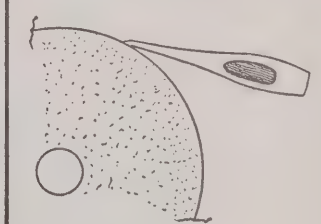
 1. AFTER JOINTING & SHAPING BLADE
 2. WHEN SLIGHTLY NICKED

⑥

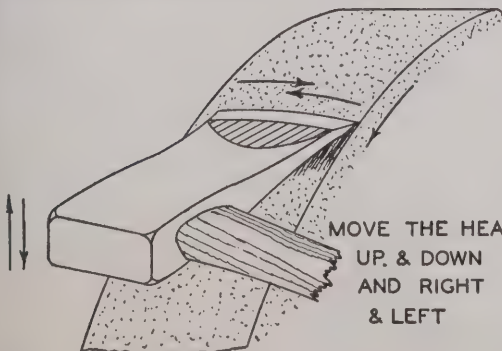


GRIND THE BEVEL

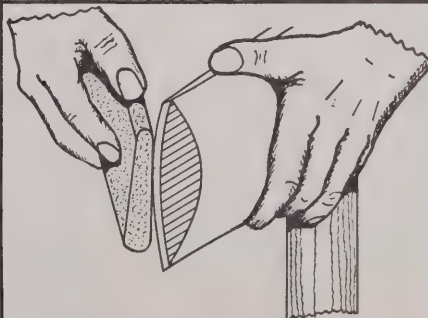
⑦


 WITH STONE TURNING
 TOWARD CUTTING EDGE—

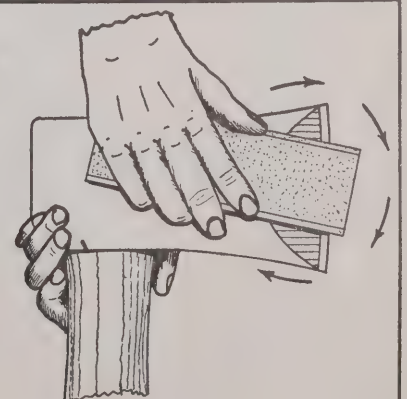
⑧


 MOVE THE HEAD
 UP & DOWN
 AND RIGHT
 & LEFT

⑨


 WHET:
 WITH CIRCULAR MOTION

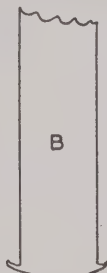
⑩



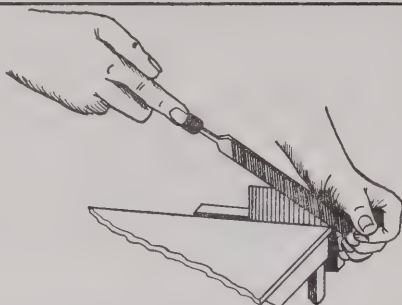
FARM SHOP SERIES

No. A-II

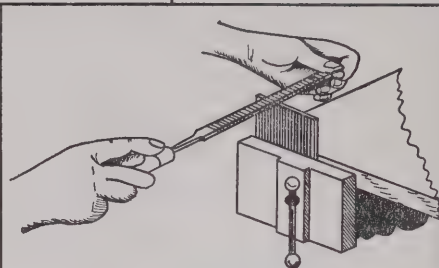
SHARPENING CABINET SCRAPER

 Dept. Agri. Engineering
 Dept. Agri. Education
 N.C. STATE COLLEGE
SINGLE
EDGEDOUBLE
EDGETHE
TWO
TYPES

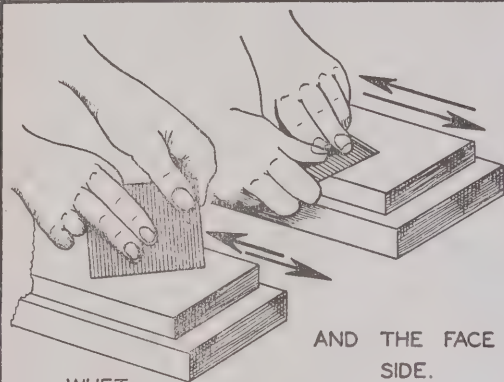
(1)

FOR SINGLE EDGE A FEW STROKES
ON FACE SIDE TO REMOVE OLD
EDGE.

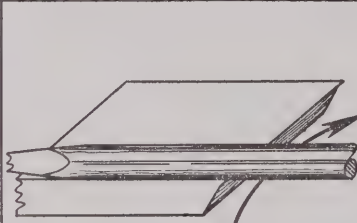
(1A)

FILE A 45 BEVEL. PULL FILE
TOWARDS YOU IN LONG
STROKES.

(2A)

WHET
THE BEVEL SIDE

(3A)

DRAW EDGE WITH A FEW
FIRM STROKES ON FACE
SIDE USING SCREW DRIVER.
A BURNISHER MAY BE
PREFERRED

(4A)

ROLL DRAWN EDGE
TOWARDS FACE SIDE
WITH FIRM EVEN
STROKES.

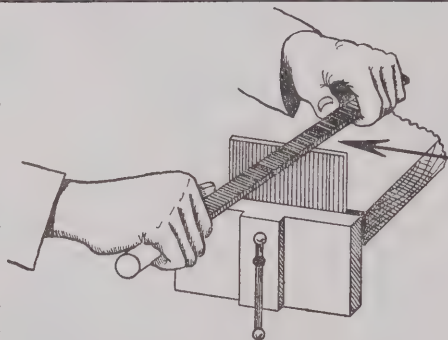
(5A)

FOR VERY FINE
WORK AND
SLOW CUTTING
PRODUCE THIS
EDGE BY
OMITTING 4A
(6A) AND 5A

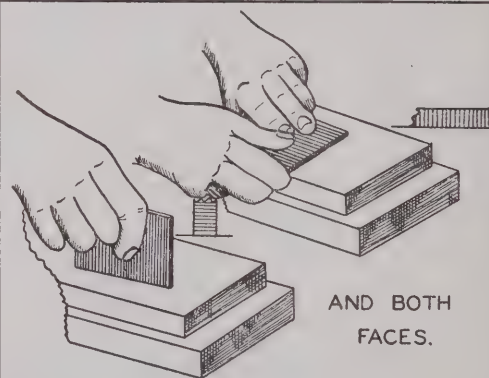
(6A)

FOR DOUBLE-EDGE
SAME AS FIGURE 1A
EXCEPT STROKE
BOTH FACES.

(1B)

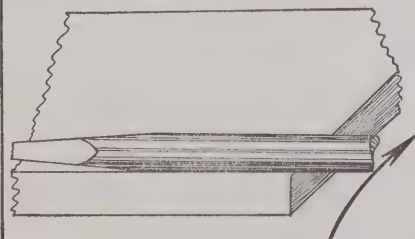
FILE THE EDGES SQUARE. PULL
FILE TOWARD YOU IN LONG
STROKES.

(2B)

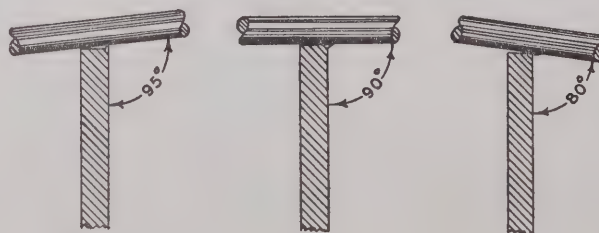


WHET THE EDGE

(3B)

AND BOTH
FACES.DRAW ONE EDGE WITH A FEW
FIRM STROKES, USING A SCREW
DRIVER.

(4B)

ROLL DRAWN EDGE TOWARDS FACE SIDE WITH
FIRM STROKES.

(5B)

REPEAT STEPS
4B AND 5B
ON OPPOSITE
FACE TO MAKE
ANOTHER CUTTING
EDGE.

(6B)

FARM SHOP SERIES

NO. A-12

GRINDING SCREW DRIVER

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Dept. Agri. Engineering
N.C. STATE COLLEGE

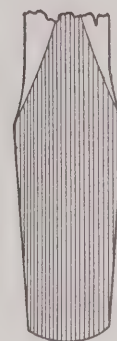
GRIND WHEN TIP IS THIN—

①



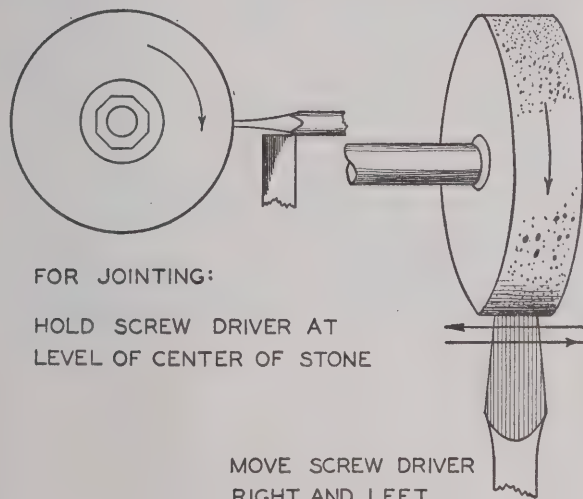
WHEN TIP IS BEVELED—

②



WHEN TIP IS ROUNDED

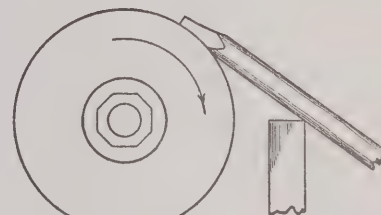
③



FOR JOINTING:

HOLD SCREW DRIVER AT
LEVEL OF CENTER OF STONEMOVE SCREW DRIVER
RIGHT AND LEFT

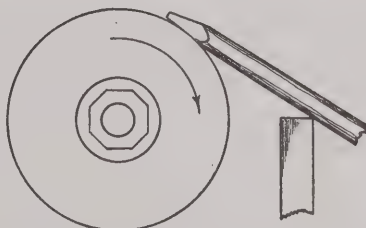
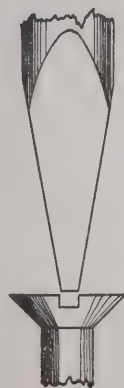
④



MOVE RIGHT & LEFT

GRIND UNTIL SIDES ARE PARALLEL
AND FIT SCREW SLOT —

⑤

MOVE RIGHT & LEFT
AND UP & DOWNOR UNTIL SIDES ARE NEARLY PARALLEL
AND FIT SCREW SLOT.

⑥

A SUGGESTION



CONCAVE



STRAIGHT

LEAVE SHANK AS STRONG
AS POSSIBLE

⑦

THIS TYPE
NEEDS NO
SHARPENING

⑧

The Teacher of Vocational Agriculture and His Work



**DEPARTMENT OF EDUCATION
NORTH CAROLINA STATE COLLEGE OF AGRICULTURE AND ENGINEERING
OF
THE UNIVERSITY OF NORTH CAROLINA
RALEIGH, NORTH CAROLINA**

FOREWORD

This bulletin is the first of a series on occupational studies and guidance.

The nation wide interest in occupational study and vocational guidance accentuates the urgent need for those who are to be the teachers and leaders in vocational education to be chosen very carefully. It is equally important that those who are considering the teaching of vocational agriculture as a profession consider well all the factors—pro and con—before making the decision.

The selection of the right type of high school graduate to enter preparation for agriculture teaching is one of the most important problems confronting the profession. There should be no group of persons better qualified to guide and advise high school boys relative to teaching as a profession than the teachers of agriculture themselves. Intimate contact with the 332 white teachers of agriculture in North Carolina should give the Department of Education at State College a preferential position with reference to the selection of candidates for the teacher training curriculum. A very select group should be guided into the profession, if the teachers believe in their work.

The department at the college is looking to the teachers of the state to help perpetuate the good work they are doing by directing into their own profession only those boys in whom they recognize the qualities essential to making a good teacher, and who demonstrate genuine interest in a profession where service to others is the paramount issue.

This bulletin, prepared by J. K. Coggin, Associate Professor of Agricultural Education, in collaboration with L. E. Cook, Professor of Agricultural Education, is designed to aid teachers in assisting boys in making a decision as to whether or not they want to enter the teaching of agriculture as a profession. It should be of inestimable value to teachers in their efforts to give their students sound advice with respect to teaching as a life work.

There is no better criterion for determining the qualities necessary for success in teaching agriculture than those qualities which have proven valuable to successful teachers. Consequently, the experiences of a number of the teachers who have been in the service for a number of years have been included in this bulletin as an inspiration to other teachers as well as an aid to the high school boy who is confronted with the problem of choosing his life work.

I hope this bulletin will be read in the spirit and used for the purposes it is written.

T. E. BROWNE, *Director*
Division of Teacher Training.

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DO YOU WANT TO BE A TEACHER OF VOCATIONAL AGRICULTURE?

One of the important duties of the teacher is to provide students with occupational information and wise counsel on the selection of their life work. Questions similar to the list below offer a suggested study outline for those students who express an interest in teaching vocational agriculture.

1. Do you live and work on a farm?
2. Are you willing to spend the early part of your life in school and in college in preparation for this work?
3. Do you make above-average grades in your school work?
4. Do your schoolmates look to you for advice and help with their problems?
5. Do you like to help them and influence them for the better?
6. Do you get along well with your associates?
7. Do you get pleasure and satisfaction from reading and studying and from solving problems especially difficult to others?
8. Do you like to attend public meetings and to seek the ideas of others?
9. Do you like to work on the farm—to grow good crops and raise fine livestock?
10. Do you like to take part in most school activities—to talk before your class, before your school club, and to take part in athletics?
11. Are you gifted in the use of tools and do you like to work in the shop?
12. If you know a teacher of vocational agriculture
 - a. What is the nature of his work?
 - b. What qualities should he possess?
 - c. What preparation is necessary?
 - d. What are the opportunities?
 - e. What do those experienced say about their work?
 - f. What are the advantages and disadvantages?

Those directly interested in this profession should make a thorough study of the nature of the work, the qualifications the teacher should possess for success, the advantages and disadvantages and rewards of the work as expressed by those most experienced in this field of endeavor.

The information in this bulletin has been secured from the most experienced teachers of agriculture in the state. The bulletin contains, among other things, statements from these teachers of why they like to teach. The advantages and disadvantages of teaching are summarized on the last pages.

THE WORK OF THE TEACHER OF AGRICULTURE

The teacher of agriculture has many duties to perform. He is a teacher in the classroom, in the shop, in the field, and in the community of farm boys and farmers. His instruction is put to a practical test under actual farm conditions by experienced farmers and their sons on their respective home farms. He follows up his instruction by visiting the home work of his students, helping them individually with their problems, and keeping records of their progress. He writes news articles for the press and puts up exhibits at community, county, and state fairs to promote his work. He assists his principal and the other teachers with the conduct and management of his school. He is especially responsible for the organization and conduct of the Future Farmers of America chapter whose membership is composed of students of vocational agriculture. In order to keep up-to-date and abreast of the times, he attends short courses at the Land Grant Colleges, special conferences for teachers of agriculture, and other conferences dealing with many problems related to his field of work. He answers calls by his students and others to assist them with special problems. Because of this close contact with his people, he is also called upon to render a variety of services relating to his work. If successful, he is looked upon as a number one community leader. Needless to say, he must constantly study the farming practices of his community, analyze and summarize community survey data, and shape these materials for use in his instruction.

He has a twelve months' job and is given a two weeks vacation in addition to the usual holidays accorded other state employees. All in all he is a very busy man and of great service to his school and community. Following is a brief analysis of his main duties:

1. Preparation for teaching

- A. Visits, interviews, and helps boys decide whether or not they want to farm.
 - 1. Classifies applications and advises with principal about selection of students.
 - 2. Enrolls students who choose the course in vocational agriculture.
 - 3. In the case of adults, works with committee of leading farmers, sends notices through the mail, press, and day students, and seeks cooperation through local clubs and business firms.
- B. Prepares and arranges subject matter and physical equipment for teaching
 - 1. Surveys community.
 - 2. Summarizes and analyzes survey data.
 - 3. Prepares program of work, teaching plan, and lesson plans.
 - 4. Develops reference library, classifies and catalogs.
 - 5. Selects, secures, and arranges appropriate classroom and shop equipment.
- C. Prepares courses of study and assists students develop their plans for study.
 - 1. Organizes content related to students' problems and needs.

2. Prepares teaching program of work, including joint activities with the teacher of home making.
3. Secures appropriate reference materials.
4. Prepares charts and graphs and other devices for instruction.

II. Teaching

A. Teaches farm boys in school, farm boys out of school, and farmers

1. Teaches the class as a group, in separate groups, or as individuals according to their needs.
2. Teaches on a doing level in classroom, shop, laboratory, and in the field on the job.

III. Follows up work

A. Visits homes and home work of all students

1. To survey opportunities and possibilities for supervised farming practice.
2. To approve or suggest changes in plans for home work.
3. To check progress of work.
4. To teach student on job.
5. To encourage student in his work and promote a practical program of education on a doing level.

IV. Organizes and conducts Future Farmers of America chapter work

A. Acquaints self with objectives, history, and work of the state and national organizations.

1. Presents in various ways information about its purposes and activities.
2. Advises and helps students in the organization of local chapter.
3. Guides members in setting up program of work.
4. Attends all meetings as adviser and supervises all chapter activities.

V. Promotes vocational education in agriculture

A. Puts up educational exhibits at community, county, and state fairs.

B. Writes news articles for the press about his work:

1. F. F. A. activities.
2. Results of supervised practice.
3. Recreational activities.
4. Shop activities.

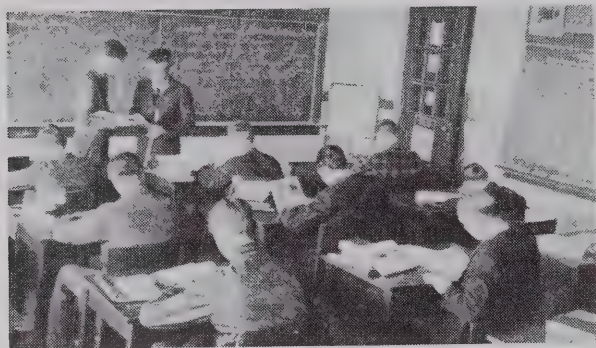
VI. Makes reports about his work

A. To the State Department of Public Instruction

1. Results of supervised practice work.
2. Characteristics of enrollment.
3. Group activities of students.
4. Records of former students.
5. Other special work.

B. To local school authorities

1. Monthly report of work done.
2. Annual report of results of year's work.

THE WORK OF THE TEACHER OF AGRICULTURE

HE TEACHES IN THE CLASSROOM,



IN THE FIELD

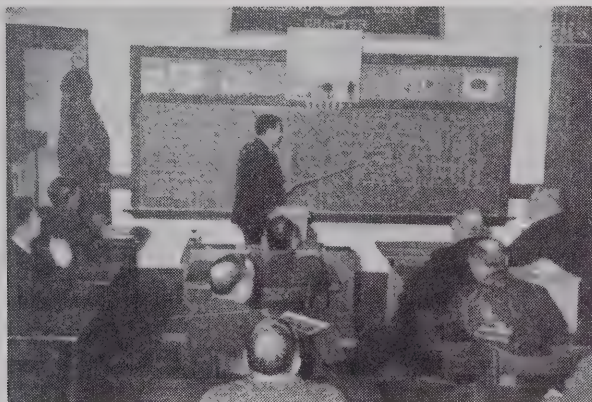


AND IN THE SHOP.

THE WORK OF THE TEACHER OF AGRICULTURE



HE CONDUCTS JUDGING CONTESTS,



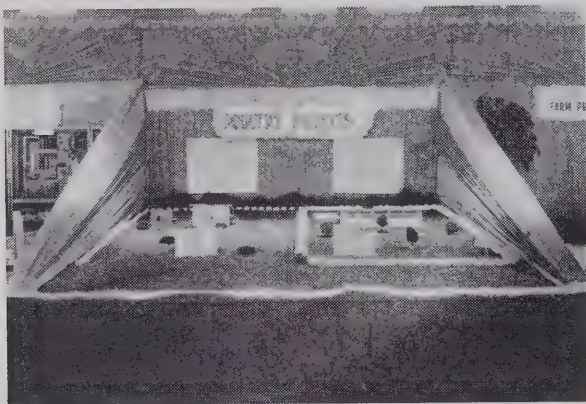
CLASSES FOR ADULT FARMERS AND OUT OF SCHOOL GROUPS,



FATHER-SON BANQUETS AND OTHER F. F. A. ACTIVITIES

THE WORK OF THE TEACHER OF AGRICULTURE

HE SUPERVISES HOME PRACTICE WORK,



EXHIBITS RESULTS OF HOME PRACTICE,



**AND COOPERATES WITH OTHER TEACHERS IN
SPONSORING COMMUNITY RECREATION.**

QUALITIES A SUCCESSFUL TEACHER OF AGRICULTURE SHOULD POSSESS

The teacher of vocational agriculture is more than an instructor in the classroom, important as that is. He is a guide and leader of youth and as such his personality and conduct are of supreme importance. To be a real teacher he must be able to "stimulate life through learning." He must be able to diagnose situations and to use good judgment in bringing about better adjustments in the school, in the home, and in the community.

Teaching is a profession. One engages in it more for others than for one's self. The statements by some experienced teachers, given elsewhere in this bulletin, offer strong testimony to this fact. These teachers emphasize the fact that a great part of the joy of the work is in service to others—service to those who need and appreciate it, and in the observation of the "true growth of men, crops and livestock, and homes about them." These teachers also point out that the salaries they receive, while not large, offer a good standard of living with enough extra to carry some insurance for old age comfort.

Making money is not the primary motive in the life of the teacher. Those interested in entering the profession should keep this in mind when making their decision.

The ideas and ambitions of the teacher give direction and strength to those of his pupils. Many students acquire from their teacher an appreciation of the higher motives and ambitions not only in the selection and carrying on of an occupation but in all of life's relationships. The teacher should be prepared to offer wise counsel to boys in the choice of an occupation. Boys are too frequently inclined to put such things as a ready job, material gain, prestige, and mere pleasure over the more worthy and enduring things such as joy and satisfaction in the performance of a job well done. The successful teacher of agriculture also finds joy in helping his students solve their many problems at school, at play, at home, on the farm, or wherever the problems arise. Service to others is one of his greatest satisfactions.

The teacher should have a good measure of self-control, poise, and a sense of humor. He should be open-minded, yet he should have opinions and convictions based on reliable information and sound thinking so that he will not be swayed by every fad and "ism" that confront him. He should develop the habit of making observations, of seeking a wide range of information, and of using good common sense before passing judgment.

The teacher of agriculture, if successful, is very industrious and uses good judgment in his business relations. He makes only such financial obligations as he can meet. He makes purchases in keeping with his needs and salary.

The teacher of agriculture must be well trained. He needs a rich background of science and economics to be able to interpret to youth and adults sound agricultural practices. At least four years of training in an agricultural college is required in his preparation. He must have good health and be mentally alert. He must be willing to give and take. He should be blessed with a happy balance between theory and practice in agricultural practices, in religion, in politics, and in other human relationships.

He must maintain a breadth of interest and a high regard for the profession he has chosen. He should enjoy the opportunity for inspiration through

lectures, concerts, conferences, summer schools, and visits to other teachers, observing their work and the work of their students. He should have vision and continue to grow. He should be able to get along well with his fellow workers, his students, and the people of his community.

Teaching requires an abundance of nervous energy, therefore he should budget his time to provide for the necessary wholesome forms of recreation and vacations in order to keep in good physical condition. He should observe the principles of good health to the end that he may be cheerful, optimistic, stimulating, and possess something of a spiritual nature so that he may be able to transmit these qualities to others.

EXPERIENCE AND PREPARATION NECESSARY TO ENTER THE PROFESSION

Practical farm experience is one of the fundamental qualifications of a teacher of vocational agriculture. It is very desirable to have been reared on a farm, and experience in vocational agriculture in high school is a decided asset. Further farm experience, if possible on the boy's own responsibility, adds materially to the teacher's equipment.

In view of the emphasis now being given to vocational guidance, knowledge and experience in other fields of work, especially those related to agriculture, add considerably to the teacher's usefulness. Students interested in preparing themselves for real achievement in teaching vocational agriculture should be cautious about rushing into and through their academic preparation to the neglect of practical vocational experience.

We regard experience as activity and situations in life which have meaning for us; therefore, farm experience should be more vital as we increase in knowledge and maturity and according to the strength of our purpose and the degree of our responsibility.

Students looking to the teaching of vocational agriculture should be encouraged to secure the best experience possible, but as a minimum a student should be farm reared or should have the full equivalent of two years of farm experience before starting his professional preparation.

The North Carolina State College of Agriculture and Engineering of the University of North Carolina, at Raleigh is the institution designated by the State Board for Vocational Education to prepare the white teachers of vocational agriculture in North Carolina. The curriculum to be followed in their pre-employment training is set up by the Department of Agricultural Education. Students registering in this department are required to have a total of 225 term credits and an equal number of points for graduation. Students who meet these requirements are granted the degree of Bachelor of Science in Agricultural Education and are automatically eligible for a state certificate to enter the profession.

OPPORTUNITIES IN THE FIELD OF VOCATIONAL EDUCATION IN AGRICULTURE

North Carolina has 332 white teachers of vocational agriculture (1938-39)—one of the largest number of any state in the Union. The program of vocational education in agriculture in this state has had tremendous growth both in the number of schools offering the work and in public interest in support of the program. There has been and still is a strong demand for new teachers in this field. This strong demand has been due not only to the growth of the program with the consequent addition to the teaching force but also to the demand for replacement of teachers who left the work for higher salaries paid by emergency and related agencies. A reasonable turnover of teachers is to be expected in any year. A ten percent turnover will require in the future about thirty-five men for replacement alone. In normal years this has been about the percentage of turnover. Any expansion of the program, and there is strong demand and opportunities for expansion, will require additional men.

Some use their teaching experience as a stepping stone to other fields of service now paying higher salaries. There is perhaps no better experience for training for the related fields of work than a few years of teaching vocational agriculture. There has been scarcely a single month in the past five years that some teacher of agriculture has not been given the opportunity to accept work in a related field at a higher salary. Many refused the offer because they would rather teach, others have accepted leaving their teaching positions to be filled by newly trained men. All men qualified by training have, almost without exception, been placed.

Those leaving the teaching service have entered in the main vocations in which their previous training and experience were directly beneficial to their new field of endeavor—training and experience which made possible their change of work and promotion. The largest number of those leaving the teaching field have entered the following fields of service: county agricultural agent, specialist in soil conservation, specialist in agricultural extension work, specialist with Farm Security Administration, teaching other high school subjects, supervisor of vocational education in agriculture, college teaching, field worker for cooperative associations, specialist with Farm Credit Administration, educational agent for commercial feed companies, fertilizer companies, and seed companies, principal of school, county superintendent, agricultural journalist, 4-H club leader, farm manager, contractor, farming, salesman, coaching athletics, insurance, private business.

A survey of the potential departments of vocational agriculture in North Carolina in 1933 revealed the fact that at that time less than half of the rural high schools with enrollments of farm boys sufficient in number to justify a full time teacher of agriculture had been reached. Despite the yearly expansion of the program since that date approximately one-third of the rural high schools of the state are still in need of teachers of agriculture. In 1918 there were 21 teachers; in 1928, 143; and in 1938, 332. It will require more than 200 additional teachers to complete the program in this state on the present basis.

In the state the number of these teachers is about sixteen times the number twenty years ago. In the nation the number is about eight times the number twenty years ago. There is still a great opportunity for expansion in both the state and nation.

WHY I LIKE TO TEACH VOCATIONAL AGRICULTURE

Of the 332 white teachers of vocational agriculture in North Carolina more than fifty percent have had five or more years' teaching experience. Sixty-four or approximately one-fifth of these teachers have had ten or more years' experience.* Requests for statements of their experience for use in this bulletin were made to the more experienced group. All the statements received are included. Twelve of those furnishing these statements will have completed, on June 30, 1939, not less than ten years' teaching vocational agriculture. One, the State Master Teacher for 1937, will have completed his ninth year of service. The total range of experience in teaching vocational agriculture represented by this group is from nine to twenty years. The statements of these thirteen teachers were made, therefore, by one-fifth of the total number who have ten or more years' experience. It is fair to them and to the other teachers of the state to say they are representative of the more experienced group.

STATEMENTS BY EXPERIENCED TEACHERS



T. B. ELLIOTT
AHOSKIE, N. C.

B.S. DEGREE, N. C. STATE COLLEGE. M.A. DEGREE,
COLUMBIA UNIVERSITY. HAS TAUGHT TWELVE YEARS
AT CASTALIA, SHELBY, MOYOCK, AND AHOSKIE,
NORTH CAROLINA.

IT IS VERY difficult for one to analyze the reasons for anything but especially is this true when it comes to distinguishing between our own individual likes and dislikes.

There are many factors that play a part in the choice of a profession. In looking back, in my own case, and thinking of the reason why I decided to teach agriculture, I can readily see how early environment had much to do with the decision.

I have always had a love for growing crops and livestock. I have always been interested in agricultural development, and have a great love for the land. After studying and seeing something of farming conditions in other sections I have felt that in our own state we have agricultural possibilities as great as can be found elsewhere. I have felt that even though very few farmers ever become rich as far as this world's goods are concerned, there is a great possibility for independence, happiness, and satisfaction to be found in the home life on the farm. I am

a great believer in the importance of the home, and believe that there is no place that so well lends itself as an ideal location to develop proper home surroundings, to rear a family of courageous young people, and to have a satisfied home life than on the farm.

The teaching of agriculture affords a good opportunity to really know farm people. Through our contacts with the boys, in our meetings with

*Data tabulated from State Supervisor's report to the United States Office of Education, Vocational Division, for the fiscal year 1937-38.

farmers and farm women, and by being able to render a service in connection with the crops, the livestock, and the home we are permitted to gain an insight into the desires, attitudes, ambitions and thoughts of the people in our community. If we are fortunate enough to win their confidence and respect, we may be able to play a small part in developing the community in which we live.

A teacher of agriculture, if he is to succeed, must keep abreast of the times. There is little opportunity for monotony in connection with his life as there is always something *new* developing to challenge his desire to learn and to grow. This in itself is a good qualification to be found in any profession.

A teacher of agriculture is dealing with a subject that is alive, and at the same time with something that is practical. If the teaching job is well done, you can see progressive growth in the lives of your pupils.

But my greatest reason for liking to teach agriculture is because I *love boys* and am glad to have a part in training and developing them. In looking back over my years of teaching I can think of some of *my* boys who have made a success in lines of work other than agriculture. I like to feel that I may have had a small part in creating within them characteristics and qualifications that may have caused that success.

In thinking of the boys who have studied agriculture under me and who are now farm citizens of their home community, I like to feel that some of them at least are better citizens and that their community is a better community because of the training that they have received, and because of their decision to settle at home.

ON DECIDING whether to enter any profession or occupation, boys should ask themselves the following questions:

1. Will the job challenge the best efforts that I can give?
2. Is the work pleasant?
3. Can I grow or advance in the occupation?
4. Is the occupation profitable, or will it give me a reasonable living for a family?
5. Will I work in pleasant surroundings?
6. Is the work physically dangerous?
7. Will I have leisure time for recreation, hobbies, reading, etc.?
8. Will the job offer me social advantages?
9. How much training is necessary for me to have in order to enter the occupation?
10. Will the type of work allow me to get ideas from others, or make use of the things other people have learned?



T. H. LECROY
SPRING HOPE, N. C.

B.S. DEGREE, ALABAMA POLYTECHNIC INSTITUTE.
GRADUATE STUDY, N. C. STATE COLLEGE. HAS
TAUGHT FIVE YEARS IN ALABAMA AND FIVE YEARS AT
SPRING HOPE, NORTH CAROLINA.

11. Will the occupation allow me to influence other people, mold thought, and to show leadership ability?
12. Will I be my own boss, will I be closely supervised, or will I be able to supervise others?

Applying the above questions to the teaching of vocational agriculture, my opinion, after ten years of teaching, is that:

The teaching of vocational agriculture will challenge more than the best in any teacher. It is no lazy man's job. The variety of activities of the teacher of vocational agriculture in class work with boys, evening schools with adult farmers, organization activities in the community, and community service work makes it necessary that the teacher put thought and effort into his job. Teaching vocational agriculture never becomes "stale." You need never get into a rut. Those teachers who become "stale" or get in a rut do not last long at one place. "Never a dull moment" might be said of every outstanding teacher of vocational agriculture.

Due to the fact that teaching vocational agriculture has variety, the work is usually pleasant. It does not become monotonous. Associations with other people are generally on the best of terms. There is pleasure in giving. The teacher of vocational agriculture is a giver of service.

The occupation is often a stepping-stone to higher positions. Many outstanding men in educational and agricultural professions in the United States today have once been teachers of vocational agriculture.

The salary rating is fair considering the salary rating of other teachers in our public schools. The pay is on a twelve months' basis. In North Carolina, the pay check comes generally on time. An agriculture teacher can live reasonably well and support a family on his salary.

No more healthful and pleasant surroundings can be had than those found on the farm and among farm people. They live the simplest life, the most peaceful life, and, on the whole, the most satisfying life of any occupation. I have cured many spells of discouragement and even minor physical ills by getting out and visiting a few farmers and their boys on their home farms. It makes one forget the small unpleasant things.

The insurance people rate teaching as one of the least risky professions and occupations. Teaching agriculture has some physical risks. Dealing with livestock, driving a car, shop work, and possibly other phases of the work carries some danger. The danger is just enough to make the work interesting.

When you find a teacher of vocational agriculture who takes no time off for some hobby, you will find a curious fellow. We generally go in for some hunting, fishing, athletics, or some sort of diversion. The teaching schedule of the teacher of agriculture is generally such that reading is necessary in order to teach effectively. Outside reading can also be done where the individual wishes to do so. However, there is as a whole, less leisure time for the teacher of vocational agriculture than for any other teacher in the public schools.

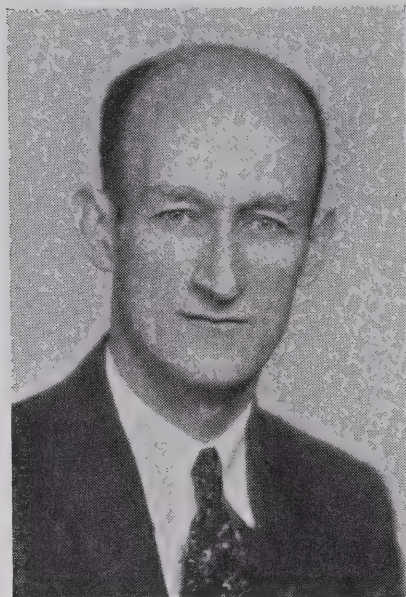
In most communities, the unmarried teacher of agriculture is a decided social asset among the unmarried ladies. Married teachers of agriculture generally have access to the best society of the community and a standing invitation to the best homes as well as the poorest homes. He is a real servant among and for all his people.

The teacher of vocational agriculture should never feel that his training is complete. He should take advantage of every opportunity to do his job better. For the purpose of promoting better training for teachers on the job, special summer short courses are offered by the Land-Grant Colleges.

Some of the best teaching material a teacher of agriculture can get is that which is found in the community where he works. He need not carry an encyclopedia of memorized facts except on fundamentals. The most fundamental principle for a teacher of agriculture to remember is how to get and evaluate information, and how to apply it.

A wide-awake teacher of agriculture is usually a very influential person in a normal community. He has a wide variety of contacts. He is generally one of the few college-trained men who takes an active part in all phases of the rural community life.

As a whole, the teaching of vocational agriculture is interesting, challenging, healthful, pleasant, satisfying, educational, scientific, and honorable. The pay is medium. The variety of work and the scope of knowledge necessary for success in this work are great. There are times when the job is trying and when it takes a lot of patience. But molding young men into useful citizens, assisting them to increase their economic status, and watching them grow into the business of farming offers me a very satisfying reward.



R. S. DUNHAM
CARY, N. C.

B.S. DEGREE, N. C. STATE COLLEGE. "GRADUATE
STUDY, N. C. STATE COLLEGE. HAS TAUGHT NINE
YEARS AT CARY, NORTH CAROLINA.

THE ONLY fair standard by which you should judge a vocation is the one which you have set up as your life's objectives. In other words in your own mind you must set up the criterion as to just what you wish to accomplish in the short time which you have to contribute to society. You should answer the question, "What is the greatest good that I may be able to accomplish for myself and society?"

Just why I like to teach vocational agriculture may be explained in a few words which tell how this vocation meets the four standards which most normal individuals set up in one form or another.

1. Most of us want friends, or at least favorable recognition from our group.
2. We want to excel in something.
3. We want to pay our own way in society.
4. We want to make a definite contribution in the form of a per-

manent service to our fellow men which will live on after we are gone.

Probably there is not a single vocation which offers such an opportunity for gaining friends as does that of teaching agriculture. We are missionaries in many respects in that we have the opportunity to set up a training program based on the most urgent and long-time needs of our respective communities. Whether the community accepts or rejects our program depends upon how well we diagnose the needs, and upon how thoroughly the teacher sells himself to his group. We can make friends because we are dealing primarily with young rural men who appreciate anyone's taking time to help them with their problems. We can make friends with their mothers and fathers as well as with other members of the community, for we are working with problems that are of direct concern to them. Service to the cause of Rural Life is the watchword of the teacher of agriculture. Therefore, something is wrong when the teacher of agriculture fails to be one of the best thought of men in the community. He can and should be one of the foremost leaders of his group.

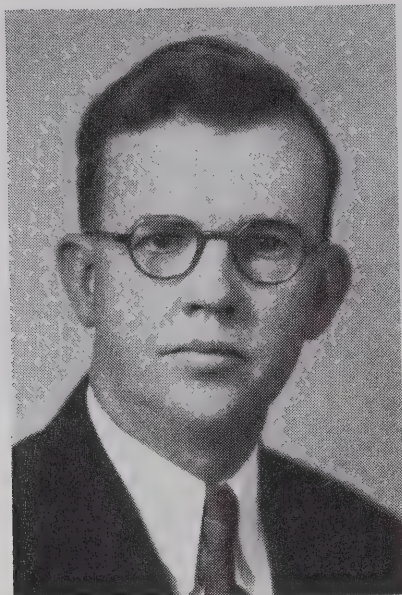
By basing the program on the needs of the community, the teacher has an unusually good opportunity to make an outstanding program, because there are no two communities or groups of people alike any more than there are two teachers of agriculture alike. Most communities need something and no two necessarily need the same thing. There is no individual better able to find out what the community needs or in a better position to help bring about the solution to these problems than is the teacher of agriculture.

Therefore, he has the chance of a life time to excel in something—the building of a satisfying rural life—a very definite something if he is willing to see it through to a finish.

Most teachers of agriculture can maintain a respectable standard of living on the salary received. It is not so much as he would like to have, but I am yet to see the person that is getting as much salary as he would like. It is probably not as much, from a monetary standpoint, as he could earn in a private business but at the same time he is able to pay his own way. He will never get so much from his teaching that he can feel for any length of time that he is teaching for the money that is in it. The service motive will always be in the forefront.

Since we are dealing primarily with rural people, and young men at that, our chances of rendering a permanent service to our fellow men is unusually good. Someone has said that “the farm is the alma mater of the American people.” For this reason it is up to us to help carry on in the rural areas in such a manner as to win respect and praise from the graduates of the farm as well as from those who remain working there. An attractive and satisfying rural life in every community in this country is the goal that may be reached within this generation by using the service motive as our guiding principle. “The greatest adventure in life is doing our level best.” No one can doubt that the teacher of agriculture may share this adventure along with the highest paid executives in our land.

Let me summarize by saying that the teacher of agriculture can have friends, he can pay his own way, he can excel in something, and as for making a definite contribution to society, no vocation offers a greater opportunity. For building real men, the greatest need of the world today, is our task. After teaching nine years I am yet to meet the man who I think has a better job than I.



GEORGE B. BLUM
MIDDLEBURG, N. C.

B.S. DEGREE, N. C. STATE COLLEGE, GRADUATE
STUDY, N. C. STATE COLLEGE. HAS TAUGHT TWO
YEARS AT LILLINGTON, AND FOURTEEN YEARS AT
MIDDLEBURG, NORTH CAROLINA.

LIKE TO TEACH vocational agriculture because it puts me in direct contact with life in its most vigorous form—boys twelve to eighteen years of age, the molding, building, planning age. Teaching has given me a part in this building for the future. Not just once but year by year as new lives come to me to direct and help.

Teaching may be thought of by some as being monotonous. I have found that the teaching of agriculture is just the opposite. The same lessons may be taught, the same kind of job repeated, but not in the same way. In the field of vocational education in agriculture there is such a multiplicity of thought, materials, and methods that it is almost impossible to repeat or become monotonous; that is, if one acts the part of the true teacher and reads and studies as he should.

I like to teach vocational agriculture because it is new in the field of education. We may be and have been using pioneer methods. We owe no apologies to customs, precepts, or doc-

trines. Vocational agriculture must blaze its own trail in its own way to do its part toward making American agriculture permanent. The present generation of farmers is and perhaps the next two or three generations will be in the midst of transition from pioneer to more permanent agricultural methods. Teachers of vocational agriculture stand nearest the pilot wheel and are in a fine position to help train those who will guide our farming to a place of safety and permanency. To me this part of the work is challenging with a never-ending interest.

I have found that the teacher of agriculture can live a natural life in the community of which he becomes a part. He has the opportunity and is expected to become an active leader in the community. This requires time and energy but personal advancement and service rendered is worth the effort.

The teacher of agriculture may get behind with his study and work but there is little danger of his becoming "stagnant." The daily new problems, new scientific facts to be mastered, and the advance in the industrial field makes it necessary that he learn many new and interesting things.

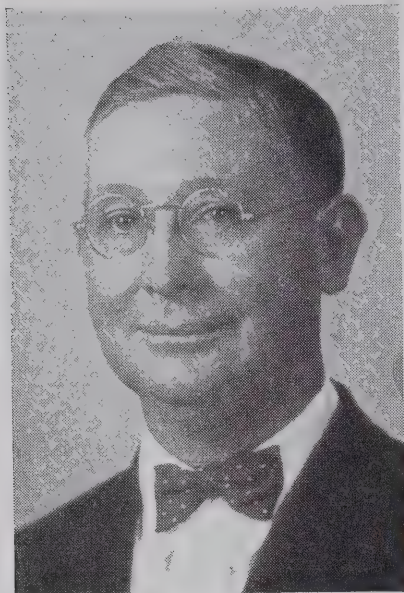
In the make-up of many Americans there is an inherent desire to create or invent something new or different. I have found that the job of teaching vocational agriculture has given me a chance to let that part of my nature exert itself. It may be in building a new kind of water trough, or lamp stand, in trying a new mixture of fertilizer, or in laying out a different grade of terrace, in the installation of a water system, or in planning and

directing the building of a community house that this desire finds expression and satisfaction.

The many interests of the teacher of agriculture in the problems of the community have often made his position difficult at the school. He cannot aid in the detail school activities as much as he or his superiors would often desire. So far, I have found the superintendents and principals with whom I have worked cooperative in their dealing and sympathetic in the interpretation of my duties and responsibilities.

No man working on a salary should expect to become wealthy. Teachers of agriculture are not an exception. The hours are long and few vacations can be taken, but the job of teaching has given me a living for me and my family—not so many of the extra things in life as some might prefer but enough for the daily need and a little for life insurance and for a place where my wife and children can call home. The desire to be of as much service as possible and to build a good department has often taken personal funds into public use. As the public and officials are becoming better acquainted with our work and needs, this handicap is not as great as it has been.

After years of teaching one can begin to see results, not in money, lands, stocks, or bonds but in the lives of the boys he has taught—many now farmers, some business men, some professional men. Most of them are a little better prepared for and more interested in life and the advancement of our civilization because men teach vocational agriculture.



G. C. BUCK
PERQUIMANS COUNTY HIGH SCHOOL
HERTFORD, N. C.

A. B. DEGREE, WAKE FOREST COLLEGE. B. S. DEGREE,
N. C. STATE COLLEGE. GRADUATE STUDY, N. C.
STATE COLLEGE. HAS TAUGHT VOCATIONAL AGRICULTURE
TWENTY YEARS AT SALEMBOURG, CASTALIA,
CONTENTNEA SCHOOL, KINSTON, AND HERTFORD,
NORTH CAROLINA. HAS HAD FOUR YEARS ADDI-
TIONAL TEACHING EXPERIENCE.

THERE IS PERHAPS no teacher who has a better opportunity to guide and teach the boy on the job, at home, and at school than the teacher of vocational agriculture. He guides the boy in making decisions about his home practice work. He advises with the parents about the student's work. He checks, in cooperation with the parents, the progress of the student.

This follow-up instruction at home and on the farm enables the teacher to carry through his initial classroom instruction and test its results on the job in its natural setting. No teacher is, therefore, offered a better opportunity to bring together so closely the needs and interests of the student and the home. "Learning to do—doing to learn" becomes a reality.

Both the teacher and the student use definite and tangible materials in the teaching-learning process. The student uses actual materials in his study and improvement of the home and landscape, of crops and livestock, and in the management and conservation of the soil, wildlife, forests, and other natural resources of his home community. The student learns for

himself the many values of his instruction and of his efforts to improve because he can readily measure the tangible results thus obtained.

Parents readily make observations of these improvements and in most cases adopt the improved practices. This establishes the good will and confidence of the parents who in turn seek the assistance of the teacher for a broader instructional service. One of the most satisfying rewards is the expressed appreciation of the boy and his parents for these services.

Rendering instructional service to both boy and parent in the classroom and on the many individual farms calls for the teacher's best efforts. To be successful the teacher must not only be well trained but must continue his training day in and day out. He must be alert to his opportunities, sincere in his efforts, honest, fair, and friendly to his students. He thus becomes adviser and counselor in both personal and school problems and affairs. In such a relationship he has one of the greatest opportunities of anyone in the community to properly mould the attitudes, habits, skills, and attendant economic and social efficiency of his students.

For my part, so long as the people of my local community are pleased with my work, I shall attempt to continue these services. Such services have a lasting reward.

I LIKE TO TEACH vocational agriculture because I like young people. Teaching agriculture offers an opportunity to develop rural leaders and to improve the economic status of the future as well as the present farmers. I can assist farmers in establishing improved practices in their farming programs that will increase the farm income, conserve the soil, beautify the home, and make life on the farm easier and happier.

Every day in the year offers new problems and opportunities to challenge me. Therefore, I must keep up-to-date on agricultural information and other related subjects. This is a stimulus to read good books, bulletins, magazines, etc.

Teaching agriculture gives me an opportunity to direct rural boys in the right ideas, ideals, and attitudes, and watch them develop into leaders, progressive farmers, and good citizens. This is a real pleasure.

I like to teach vocational agriculture because I can spend a large part of my time working in the open with plants, animals, and the soil. My work is not tiresome because there is such a variety of things to do.

Our program is based on community needs and we are permitted to use our initiative and originality in making our plans and methods fit individual cases. Being employed for twelve months, we can find time during the summer months to plan our work thoroughly and to improve ourselves professionally.

My work affords me an opportunity to meet and talk with people in all kinds of occupations. It brings me into all kinds of homes at all times, under conditions that are conducive to becoming better acquainted with the parents and boys. Thus I am in a better position to advise and help develop the ideals and conduct of my pupils.

Teaching agriculture is an honorable and noble profession and is held in high esteem in our county. The teachers are called upon to give advice and direct programs for the improvement of rural life in the county and state.

Although there is no opportunity to become rich, our salaries are sufficient to enable us to live comfortably. We can live more cheaply than people in town and have the opportunity to raise some poultry and garden products to reduce living expenses. During normal times, our salaries increase with experience. Teachers of agriculture as a rule remain in one community long enough to contribute something worthwhile to community life.



A. G. BULLARD
BETHEL HILL SCHOOL, WOODSDALE, N. C.
B.S. DEGREE, N. C. STATE COLLEGE. GRADUATE
STUDY, N. C. STATE COLLEGE. HAS TAUGHT EIGHT
YEARS AT BETHEL HILL SCHOOL, WOODSDALE, NORTH
CAROLINA. STATE MASTER TEACHER IN 1937.

At the present time the opportunity for advancement in agricultural teaching is limited. However, if a teacher is successful, he may be able to secure other related work at an increase in salary.

I believe in the future of farming and in the rural youth of today. That is why I enjoy having a part in developing these boys that are soon to be the farmers and leaders of their community.



A. B. BUSHONG
ELLENBORO, N. C.

B.S. DEGREE, VIRGINIA POLYTECHNIC INSTITUTE.
GRADUATE STUDY, N. C. STATE COLLEGE. HAS
TAUGHT THREE YEARS AT GRANITE FALLS, AND
TWELVE YEARS AT ELLENBORO, NORTH CAROLINA.
STATE MASTER TEACHER IN 1932.

THE WRITER likes to teach vocational agriculture because it gives him an opportunity to serve best, especially one group in society which needs help perhaps more than any other group today. To help someone in need should be the foremost purpose in life, and the greatest satisfaction from living. Hence, the teacher of agriculture feels that his work is justified and it is satisfying to his body, mind, and soul.

Since the teaching of vocational agriculture has to do with the production of plants and animals and with rural improvements, it is an interesting subject to teach. Perhaps there are no other subjects that are more interesting than those that deal with the plant and animal kingdoms.

The writer, again, likes to teach agriculture because knowledge is sought or given with the aim, "learning to do—doing to learn!" In agriculture we teach on the basis that there is a need for obtaining knowledge; and then apply it immediately.

This type of instruction is gratifying to both teacher and students because they can quickly see the results of obtaining and applying knowledge to some problem of interest.

Another reason why the writer likes to teach vocational agriculture is that a part of the work is in the classroom and shop, and the other part is outside, observing knowledge at work when applied by students or teacher individually or by the group.

Finally, teaching agriculture gives the teacher an opportunity not enjoyed by some to build boys into men of responsibility and character as he deals with them in school, at home, on trips, at banquets, and at various leadership conferences and contests.

I ENJOY TEACHING vocational agriculture because it gives me the opportunity to work with boys in educating and molding them for a fuller, happier life, and therefore offers me an opportunity to help build a better community for all. There is a certain pleasant feeling of pride that comes from being a teacher, friend, and confidant of the boys, and a respected leader of the community. It seems to me that teaching—working and associating with young people—helps one more than any other occupation to keep young longer, and to live in the present and future instead of the past.

As a teacher you have more home life and friends than is possible in many other lines of work. You can usually be at home nights, week-ends, and holidays. Through agricultural conferences, group meetings, summer schools, contests, Y. T. H. F. camps, meetings of other agricultural and educational agencies, a teacher meets and makes many friends with some of the finest people in the state.

I like the country and country life especially in this age of good roads, automobiles, radios, and other conveniences that the country has. In most communities where there is a high school, we have a large part of the city conveniences with all the advantages of the country.

While the remuneration in dollars and cents is not as much as it is in some other occupations, it costs less to live in the country or small village. Teaching vocational agriculture is a year-round job. Usually there is an opportunity to keep a cow, chickens, and have a garden. These help to keep down expenses. During depressions the teaching profession is more stable than many other occupations. Teachers have more time for self-improvement through summer schools, conferences, and numerous other things than people in many other professions.

To me teaching agriculture does not become monotonous. There are new problems every day, some with the boys and their parents, others in the field of new ideas and methods in agriculture. Our work is not confined to any one room or place but takes us to the classroom, shop, field, laboratory, and farm.

We are allowed in a large measure to work out and steer our own course in the community in which we teach. This gives the teacher a chance to develop self-reliance, initiative, and leadership in thought, deed, and action that very few positions offer. Next to farming, teaching agriculture offers the best opportunity to put into practice, through the boys and farmers, the latest ideas and methods in agriculture.

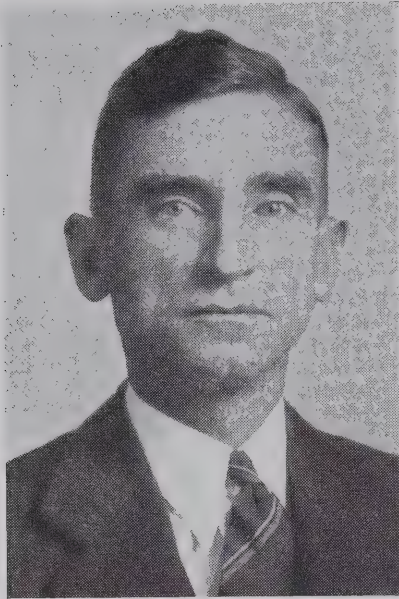
It is a joy and pleasure to see the happiness and pride in a mother's face when some labor-saving device, which you were instrumental in producing or securing, has been installed.

To teach agriculture in North Carolina is a pleasure because of the very able leadership, guidance, and counsel of administrators under whom I work. They are always just, reasonable, and fair-minded.



T. P. DELLINGER
CROSSNORE, N. C.

UNDERGRADUATE WORK, BEREA COLLEGE, SPECIAL
STUDY, N. C. STATE COLLEGE. HAS TAUGHT NINE-
TEEN YEARS AT CROSSNORE, NORTH CAROLINA.



L. C. HERRING
CONTENTNEA SCHOOL, KINSTON, N. C.
B.S. DEGREE, CLEMSON COLLEGE. GRADUATE STUDY,
N. C. STATE COLLEGE. HAS TAUGHT ELEVEN YEARS
AT RICHLANDS, AND SIX YEARS AT CONTENTNEA
SCHOOL, KINSTON, NORTH CAROLINA.

THIS IS MY eighteenth year as a teacher of vocational agriculture. There are too many advantages, too many satisfactions in my present vocation for me to change to other work. My experience in other fields of work and my observations of other professions have magnified these advantages. This, no doubt, explains why I am still teaching and enjoying it.

Teaching is one of the most important of all the professions. An agriculture teacher deals mostly with farm boys. My observation of farming methods and living conditions in rural communities creates in me a desire to lend my little bit toward improving these conditions. Helping to mold the lives of these fine young farm boys, to improve their economic, social, and spiritual status is challenge enough to keep me interested and going forward with a satisfaction that I am afraid many other workmen fail to realize. We see our teaching tested in the behavior of growing young citizens, tested in the development of finer crops and livestock, tested in the development of more convenient and

more beautiful homes, all resulting in a richer community life.

Our associations are pleasant in that our field work brings us in direct contact with the parents of our boys. No normal person can know and associate with these fine people without deriving great pleasure from the experience. We learn too. It is educational to study farm people, their methods of farming, and their methods of homemaking. Being thrown with people of good character and knowing that the best behavior is expected of us as teachers causes us to strive to live a life of self-respect which merits and commands the respect of others. Teaching may not be considered by some as one of the greatest professions but it is at least a respectable one. No good teacher should be ashamed of his profession.

The salary paid teachers of agriculture is small considering their training and expenses but it compares very favorably with the salaries paid in many other vocations and professions. We have continuous employment, a decided advantage over those engaged in work offering only part-time employment.

Good health is one of the greatest assets of human life. Our work takes us to the classroom and to the field. It offers and requires the necessary physical exercise for good health.

Looking back over my experiences, I would say the fuller life is in the living—living at home, living with my people, serving those that appreciate and need me, and enjoying the true growth of men, crops and livestock, and homes about me. To me it is very satisfying and I apologize to no man.

FARMING IS ONE of the oldest and most honorable vocations in the world, therefore teaching it is an honorable position. The teacher of agriculture is usually considered one of the most valuable citizens of his community and commands the respect of his people.

Agriculture is keeping pace with other industries in making progress. For this reason the teacher has something of interest and value to inspire and challenge him. It offers an ideal situation for keeping up-to-date on agricultural information.

The opportunity for studying human nature, and developing ability to lead rural people into better living is ideal. The successful teacher develops the ability to associate with all classes of people. In order to be a real success one must develop a good character. Success is not measured in terms of financial gain but in terms of worthwhile service to humanity. The teacher of agriculture has this opportunity at its fullest.

The salary of a beginning teacher is low but is substantially increased with experience and success. He is employed for twelve months. Having a fair, stable income makes it possible for the teacher of agriculture to establish reasonable financial credit with little difficulty, and gives him the opportunity of investing in other enterprises with reasonable assurance that he can finance them.

The teacher of agriculture is allowed a vacation at a time during the summer that he thinks he can best leave his work. This gives him a chance to relax and forget his work. Everyone works best after a mental and physical rest. The vacation is allowed with the salary continued.

A teacher of agriculture becomes familiar with many related professions and occupations. Therefore, if he should desire to change his vocation, he is in line for a number of other positions; such as, farming, extension work, salesman of agricultural supplies, agricultural specialist, etc. If he has made good as a teacher, he has acquired certain characteristics and skills that will place him in demand for many public positions.

Some of the most valuable leaders of our country have come and are now coming from our farms. Since this is true, the teacher of agriculture has an opportunity to play a big part in training the future leaders of our great country. He is ideally situated for improving both the economic and social life of farm people. Such an opportunity for service should and in most cases does make real men of those who enter the service.



P. H. JAMESON
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B.S. DEGREE, CLEMSON COLLEGE. GRADUATE STUDY,
N. C. STATE COLLEGE. HAS TAUGHT THREE YEARS
IN SOUTH CAROLINA AND SEVEN YEARS AT WOOD-
LAND, NORTH CAROLINA.



R. H. LANKFORD

WEST BUNCOMBE SCHOOL, ASHEVILLE, N. C.

A. B. DEGREE, SOUTHERN NORMAL UNIVERSITY. HAS TAUGHT VOCATIONAL AGRICULTURE TWELVE YEARS AT HARMONY, AND MT. PARK INSTITUTE, MT. PARK, N. C. HAS HAD TWENTY YEARS ADDITIONAL TEACHING EXPERIENCE.

THERE ARE so many reasons why I like to teach vocational agriculture that I can give only a few of the most salient and appealing. In the first place, I am intensely interested in the subject because it is THE ONE closest to my heart. Contact with the boys in this relation is possibly closer than in any other department of school work, because it brings me in contact with the homes and parents of the boys, thus enabling me to observe, study, and discuss home conditions with boys and parents in matters of common concern.

It is not only satisfying, but actually enjoyable, to observe the development of skills and the ripening of judgments of boys in such practices as the use and care of tools, farm machinery, etc., and in selective and comparative judging of farm seeds and crops, livestock, and their care and keeping.

F. F. A. chapters in session, father and son banquets, along with other social activities are highly potential factors in developing qualities of leadership; and cementing into mutual concern the spirit of cooperation,

thereby contributing much to the real objective of the Department of Vocational Agriculture.

IN THE INTEREST of brevity, I shall list in more or less outline form the advantages of teaching vocational agriculture based on my twelve years' experience. The many advantages of the vocation are:

Intimate contact with farmers and farm boys.

The opportunity to serve farm people in such a way as to gain their confidence, good will, and respect; and to render such service as will assist them in increasing the farm income and improving living conditions.

Boys in vocational agriculture classes usually look upon their teacher as a model after which to pattern their own lives, and as a leader and adviser rather than as a task master.

The vocational agriculture teacher usually knows the community and is in a position to furnish constructive leadership in community problems.

The services of the agriculture teacher are usually appreciated by the people he serves.

His work deals with current problems—he teaches usable material of immediate value to students.

Vocational teachers are not bound by a prescribed course of study. Ample

opportunity is offered for the use of individual initiative.

The beginning salary compares favorably with that in almost any other type of work a college graduate might enter. Employment is for twelve months with a salary high enough to make it possible to live comfortably.

Employment is reasonably sure even though the tenure in one community may be short.

The teacher becomes acquainted with agricultural leaders connected with other agencies, extension service, soil conservation service, experiment station workers, and many other related services.

He can depend upon the assistance of the supervisory staff in solving local problems and in looking after the interests of the program.

A spirit of cooperation and friendship exists among agriculture teachers in general and especially those in the same county.

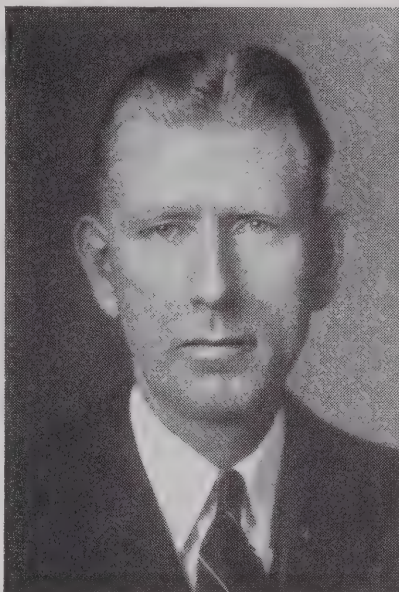
Time is available during the summer for planning the coming year's work and for self-improvement through attendance at professional meetings and summer school.

Living in the country or small town gives a chance to know people intimately.

In conclusion I should like to state that I think that the teaching of vocational agriculture has afforded greater opportunity for self improvement than any other work I might have entered. One comes in contact with a large number of people and must develop the ability to meet and deal with all types of individuals. The very nature of his work compels him to develop his ability to speak in public, an invaluable asset to him personally.

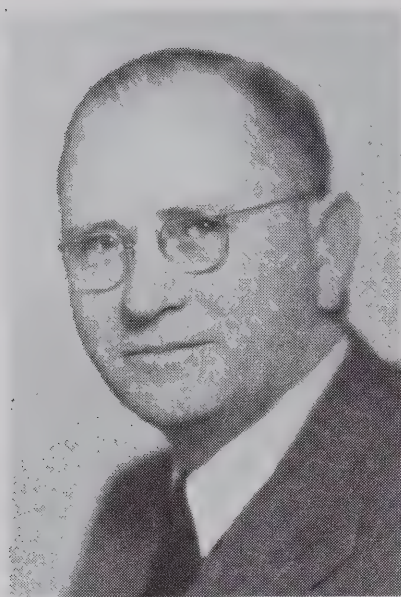
The teacher of agriculture must have a broad knowledge of the field of agriculture. This knowledge must be kept up-to-date. He is thus not likely to lose interest in current affairs.

These are some of the considerations which cause me to remain in the teaching profession after a long period of years.



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ARCADIA SCHOOL, LEXINGTON, N. C.

B.S. DEGREE, N. C. STATE COLLEGE. GRADUATE
STUDY, N. C. STATE COLLEGE. HAS TAUGHT ELEVEN
YEARS, AT KERNERSVILLE, STONEVILLE, MADISON,
THOMASVILLE, AND ARCADIA SCHOOL, LEXINGTON,
NORTH CAROLINA.



M. L. TATUM
JONESBORO, N. C.

B.S. DEGREE, N. C. STATE COLLEGE. GRADUATE STUDY, N. C. STATE COLLEGE. HAS TAUGHT FIFTEEN YEARS, AT RED OAK, JAMESVILLE, TABOR CITY, AND JONESBORO, NORTH CAROLINA.

AGRICULTURE has been called "the noblest pursuit of man" and rightly so, for it is the basis of our modern civilization. The future success of civilization is largely dependent upon how efficiently the farmer of tomorrow does his job.

There is no occupation today wherein thorough training and preparation for life is of more importance than that of farming. The teacher of agriculture has a great opportunity to render unselfish service in the training of farm youth which will make of them more useful citizens in their chosen field of work. Therefore, I consider myself fortunate in having the privilege of playing a small part in training the farmers of tomorrow upon whose shoulders rests such a great responsibility.

The knowledge and practices of agriculture are in a continuous state of change. Methods and practices which are accepted as good today may by tomorrow be discarded to make way for new ones. The teacher of agriculture is challenged to keep abreast of these changes through study and research which affords him opportuni-

ties for extending his educational horizon beyond that offered by most other fields of teaching.

His close association with nature in all its mysterious working is both educational and inspiring. He is dealing directly with life in all its forms and seeking to so aid and direct the growth of plants and animals that they may the better serve to bring to mankind the economic necessities, the pleasure, and happiness which God in His creation intended they should.

The work of the teacher of agriculture is varied, thus breaking the monotony of regular classroom teaching. Much of his work is out of doors which furnishes opportunity for healthful exercise. His numerous routine visits with the farmers and boys makes possible pleasant social contacts and opportunity to make friends.

The teacher of agriculture stays in the community the year round and can, if he chooses, closely associate himself with the economic, social, and spiritual life of the people. This affords him further opportunity for self-improvement and for rendering service where it is most needed.

But the greatest challenge of all, the one which appeals to me most, is the opportunity to serve present and future civilization through the training of rural boys to take their places of leadership in the rural communities of tomorrow. There is no group in our country in greater need of well-trained, industrious, and dependable leadership than our great rural population, and I feel that there is no more worthy calling than training boys to fill that need.

In consideration of the rapidly changing status of agriculture in our national life, it becomes a challenge to men of vision to train courageous leaders who will guide the farmers of tomorrow and direct them in assuming their rightful place in the economic, social, and political life of our country.

A SUMMARY OF THE ADVANTAGES AND DISADVANTAGES OF TEACHING VOCATIONAL AGRICULTURE

ADVANTAGES

1. Teaching vocational agriculture offers a splendid opportunity to render a distinct service to farm youth, and to improve the economic and social status of farm life.
2. It affords valuable experience in:
 - a. Establishing scientific agriculture in practice.
 - b. Making successful contacts with people and studying human nature.
 - c. Developing the ability to lead farm folks.
 - d. Teaching and guiding farm youth.
 - e. Promoting more effective organizations in rural communities.
3. Teachers form desirable associations with a good class of people.
4. The teacher of agriculture works more or less in the open air, and at a variety of activities, therefore the conditions of work are usually healthful and comparatively free from hazard.
5. Occupations related to agricultural teaching are numerous, therefore, if he should lose his position or desire a change, the teacher has a number of opportunities to consider, such as, farming, salesman of agricultural supplies, extension work, agricultural specialists, etc.
6. The teacher of agriculture usually lives in a rural community or small village where living expenses are reasonable. He can usually have a garden, chickens, etc.
7. He can invest in a farm and supervise the management of it, provided conditions are such that it will not interfere with his teaching.
8. Reasonable financial credit is not difficult to establish.
9. In normal times the salary is stable, and there is little financial risk and uncertainty in his income.
10. A rural home has many advantages in the rearing of a family.
11. Sometime in the summer is available for making preparation for the coming year's work, for professional study, and other means of self-improvement.
12. Frequent trips to a town or a city are essential in his work, thereby bringing him into contact with many classes of people.
13. He has an opportunity to use his initiative and industry in such a way as to bring his work into such prominence that his services are sought by others at a substantial increase in salary.
14. In normal times the work offers a fair initial salary which increases with experience and success. Employment is for twelve months.
15. It affords the satisfaction of being in a noble, altruistic vocation.
16. Teaching agriculture offers a stimulus to keep up-to-date on agricultural information and other knowledge related to the work.
17. Teachers in general have a tendency to set up and to maintain high ideals.
18. Teaching is an honorable profession and is worthy of the highest esteem of society.

19. The teacher of agriculture comes into very intimate contact with farm boys, and in many instances is the hero of these boys, therefore the influence of his personal example, teaching, and advice is a dominant force in developing their ideals and standards of conduct, and in giving directions to their whole outlook on life.
20. Teaching offers new problems and opportunities as the days and years go by, therefore, the progressive teacher constantly has something of interest and value to challenge him.
21. Teaching is guided by certain objectives and principles, but the individual teacher has abundant opportunity to use his initiative and originality in devising new plans, methods, and programs especially in the field of agriculture.
22. Good character is essential in the teacher, therefore to succeed he must cultivate the good life.
23. Of all the professions, teaching offers the finest opportunity to fashion the ideas, ideals, attitudes, and conduct of the rising generation.

DISADVANTAGES

1. There is uncertainty of employment in one locality for any definite period of time, making home ownership a somewhat risky investment.
2. There is no opportunity of becoming wealthy from the salary paid.
3. There is only a limited opportunity to provide for comfortable old age.
4. The age of retirement is comparatively early, and at present in North Carolina, there is no provision for a retirement annuity.
5. The income from teaching on the average is not commensurate with ability, industry, and enterprise, compared with other professions.
6. The opportunity for advancement within the field of agricultural teaching is decidedly limited.
7. Teaching taxes heavily the supply of nervous energy.
8. If successful he must lead a very active, strenuous life, which requires a robust constitution.
9. Frequently too much is expected of a teacher of agriculture in the way of time and service, especially in activities not directly related to his job.
10. A teacher is called out frequently at night, and on Sunday, to answer service calls, and must be away from home during the evening a great deal.
11. There is little opportunity on the average to put into actual practice himself the things he teaches and promotes.
12. The responsibility of the teacher of agriculture is sometimes heavy. He is called on for advice and service on many important problems, from sick animals and other emergencies to problems in cooperation.
13. Rural life in many sections still lacks certain advantages of city life, such as good doctors, nurses, sanitary conditions and conveniences.
14. The teacher is sometimes subjected to unjust public criticism.
15. He lacks freedom in behavior, religion, and politics, especially in expressing views not in accord with opinions commonly held in the community.

FARM SHOP ACTIVITIES AND EQUIPMENT

FOR

STUDENTS OF VOCATIONAL AGRICULTURE

BY J. K. COGGIN



DOING A COMMON HOME REPAIR JOB

DIVISION OF TEACHER TRAINING
NORTH CAROLINA STATE COLLEGE OF AGRICULTURE AND ENGINEERING
OF
THE UNIVERSITY OF NORTH CAROLINA
RALEIGH, NORTH CAROLINA

ACKNOWLEDGMENTS

The writer wishes to express his appreciation to all members of the staff of state supervisors and teacher trainers for their cooperation in the preparation of this bulletin; especially to Leon E. Cook, professor of agricultural education, for reviewing the manuscript and making helpful suggestions and to L. O. Armstrong, associate professor of agricultural education, for the free-hand part of the drawings on pages 26 and 27; to T. C. Brown, instructor, mechanical engineering, for all mechanical drawings; to J. G. Weaver, assistant professor of horticulture, for his instruction in photography and the pictures made by him on pages 31 and 40. The majority of the other pictures were made and printed by the writer, except as noted.

Acknowledgment is made to G. W. Giles, assistant professor of agricultural engineering, for helpful suggestions; to the agricultural economists and others for their contributions beginning on page 9; to J. Warren Smith, associate professor of industrial education, for many suggestions in the preparation of the manuscript and for securing pictures from teachers of industrial education as follows: Gerald Hicks, Wadesboro High School, C. G. Lampley, Dunn High School, and Murray Thornburg, Durham High School; and to D. M. Clements and W. A. Ross, Federal Agents of Agricultural Education, Office of Education, Washington, D. C., for reviewing the manuscript.

Acknowledgment is also made to the following teachers of vocational agriculture in the State who cooperated by arranging for the pictures used in the bulletin: George B. Blum, Middleburg; Carl Brindley, Woodleaf; G. M. Britt, Stokes; W. Bruce Butler, Wendell; H. N. Cherry, Leggetts; John Cooley, Seaboard; C. O. Davis, Cornelius; H. A. Dinning, Granite Quarry; J. M. Hagy, Lowes Grove; Fred L. Hunt, Fuquay Springs, and also pictures made by him on pages 14 and 15; A. B. Hunter, Alamance; C. G. Lawrence, Oakhurst; K. H. McIntyre, Red Oak; Oliver Manning, Dunn, for making pictures used on front cover page; H. G. Johnston, Pittsboro; M. O. Phillips, Coats; P. H. Satterwhite, Cleveland; George Sturgeon, Saratoga; R. B. Winchester, Mount Gilead; and to the many students of vocational agriculture whose pictures appear in the bulletin.

FOREWORD

This bulletin is designed for use of teachers of vocational agriculture. It was prepared, first, to emphasize the importance of farm shop work in a well-balanced program of vocational education in agriculture and, second, to aid teachers of agriculture in setting up and arranging adequate equipment for a broader shop program in the rural high schools of the State. The importance of the farm shop program, the types of farm shop activities now being conducted in the public rural schools of the State, and suggestions for arranging the shop equipment are portrayed by the use of a large variety of illustrations.

Teachers of vocational agriculture in North Carolina are urged to place greater emphasis upon the teaching of farm shop work. State College is planning to stress the teaching of farm shop to a greater degree than ever before in its teacher-education program. Ample provision for an up-to-date farm shop with modern equipment will be made in the new quarters for the Teacher Training Division.

In adapting the rural high school curriculum to the needs of rural people emphasis upon farm shop work takes on new significance. Such activities carried on by the rural high schools of North Carolina will have a far-reaching influence upon the improvement of rural homes through the teaching of farm shop to the boys and men attending the day school, part-time, and even adult classes conducted by the teachers of vocational agriculture. As has been so well brought out in this bulletin, most of the repair jobs and simple construction jobs on the average North Carolina farm must be done, if done at all, by the boy or the man on the farm.

The farm shop program, by giving to the individual an outlet for his creative impulse, takes on an educational value far beyond that usually accepted. There are great educational as well as practical material values in shop activities—not only in the thing made but also in the realization of the ability to create and do a good job with one's own hands. A worthwhile accomplishment is a source of satisfaction and joy to almost every individual and thus a source of motivation for future learning.

This bulletin, prepared by J. K. Coggin, Associate Professor of Agricultural Education, in the Division of Teacher Training at State College should be invaluable to the teachers of farm shop work. Because of his experience as a teacher of vocational agriculture and shop work, as assistant state supervisor of vocational agriculture in North Carolina, as associate professor of agricultural education, and finally because of his ability as a practical shop man, Mr. Coggin is well qualified to prepare such a bulletin. I commend it most heartily to the teachers of vocational agriculture in North Carolina.

T. E. BROWNE, *Director*
Division of Teacher Training
N. C. State College

March, 1940

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SOME VALUES OF FARM SHOP WORK

A Survey of Current Research and Opinions.—The writer made a survey of the Land-Grant colleges of the country to determine what studies had been made of the value of farm shop work towards the economical operation of the farm. Letters were sent to heads of the departments of agricultural economics of the southern states and to the directors of the experiment stations of the majority of the other states. Many interesting replies were received. Only a few states have done any research directly on this problem. However, a number of valid opinions on the problem were expressed by those replying. Excerpts of some of the studies and of some of the letters giving valid opinions are included here:

"In checking over some results of studies made here in Louisiana, it appears that the farmer who is well prepared to do his own farm shop work would save annually from \$20 to \$25 on small farms and as much as \$80 on large farms. These represent rather large savings in terms of the total net income which farmers in the upland cotton area usually receive. In the rice area, having a good farm shop—and this would mean a rather expensive outlay for shop equipment—a farmer might save annually from \$150 to \$160.

"I believe these represent fairly typical conditions for upland cotton farmers and for rice farmers in this area."—R. J. SAVILLE, *Head, Department of Agricultural Economics, Louisiana State University, University, Louisiana.*

George B. Byers and B. T. Inman, authors of the Kentucky Experiment Station bulletin 345, "The Use and Expense of Farm Implements", found that repair shops made possible a saving of \$5.47 in expense for each \$100 of implement investment. Following is a quotation from page 246 of this bulletin:

"The repair shop made possible a saving of \$5.47 in expense for each \$100 of implement investment This saving was due to the avoidance of much high-priced mechanical labor and the use of farm labor during slack periods of the year. This farm labor amounted to about forty-six hours per farm with shops and fifteen hours per farm without shops, or a difference of thirty-one hours. Having the facilities to repair implements during odd times through the year tends to keep the implements in better condition, prevents the loss of time during busy seasons, and enables the farmer to make more economical use of his farm implements."

Values of the repair shop towards the repair and upkeep of buildings and other general farm equipment was not included in the above study.

In their baccalaureate thesis, "A Study of the Home Farm Shop in Relation to Needs in Specific Areas in Indiana", Leonard Kingsley and Clarence Creager, seniors in the class of 1939, found:

- "1. Indications are that the majority of the farms studied lack suitable shop buildings in which to do their shop work.
2. According to the studies of these farms, the tools and equipment available on the farms are inadequate.
3. There seemed to be a direct influence of vocational agriculture training in the high school upon the type and quality of shops found on the farms.
4. This study seems to indicate the increased use of electrical and mechanical power on the farms of these particular areas."

Recommendations:

1. It would seem that emphasis in teaching should be placed on the proper use and care of the simple, most used pieces of shop equipment rather than the more complicated equipment that is seldom found in shops on farms.
2. The storage and proper care of equipment not in use might well be emphasized in the teaching procedures. This fact alone is undoubtedly one of the most outstanding defects of the average farm shop.
3. In setting up a course of study for the teaching of farm shop in the high school, consideration should be given to the average size of the farm and the type of farming in the community in which farm shop is to be taught, as these factors have a direct influence upon the types of farm shop jobs that are to be emphasized."

I. G. Morrison, Assistant Professor of Agricultural Education and Farm Shop Teacher Trainer, Purdue University, Lafayette, Indiana, reported the above study with this comment:

"While these conclusions do not specifically answer your questions, discussions of the problem with the boys indicated that where farm shops of any quality existed, the farmstead, the farm, and other indications pointed to the fact that the farmer was superior to his neighbor having no shop available."

"In general, our better and more successful farmers have some sort of a building or a place in a building to do the necessary farm mechanical repair and overhauling work, and for the purpose of storing miscellaneous equipment, tools and supplies. In the West much expensive equipment is used in farming and good farm management implies that this equipment is kept in good running order. Much of the repair and overhauling work must be done in slack seasons and often during periods of inclement weather which necessitates a dry and often, too, a warm place to work. These necessitate a farm shop on the farm.

"We regard the various phases of farm mechanical work arising on farms as an integral part of farming, and therefore strictly vocational. If education implies helping one to better engage in life's activities and better cope with life's problems, then effective training in all essential phases of farm mechanics is good education for one expecting to engage in real dirt farming.—G. A. SCHMIDT, *Professor of Vocational Agriculture, Colorado State College, Fort Collins, Colorado.*

"My observations lead me to the conclusion that the ability of a farmer to divide all of the farm tasks into two general classes, those which are urgent and those which are not urgent, is one of the most essential requirements of a good farm manager. Furthermore, the skill possessed by the farmer and his family in farm work shop jobs is directly correlated with income.

"However, this skill is not only needed for non-urgent tasks such as repairing fences, but also for urgent tasks such as repairing a mower. My studies indicate that, due to the seasonal nature of farm practices, many farmers confine their work to the urgent tasks and are unemployed on their own farms for a considerable portion of the year because they do not plan and lack the skill in materializing non-urgent practices."—J. WILLIAM FIROR, *Head, Department of Agricultural Economics and Rural Sociology, University of Georgia, Athens, Georgia.*

"Observation teaches us in Kansas that the farmer who maintains a farm shop and uses it is usually a more successful farmer than the one who doesn't. No farmer ever went broke because he could not do many of the small jobs continually arising on the average farm, but we do know of many Kansas farmers who have gone broke because they were continually on the road between home and town to get some small repair job done which should have been done at home.

"A good farm shop will encourage many farm boys to stay on the farm as it gives them an outlet for the urge every boy has to work with tools. A good foundation in the use of tools which many a farm boy has obtained by having a good shop on the farm has enabled many of them to adapt themselves to changing conditions which they have been confronted with after leaving the farm."—M. R. WILSON, *Associate Professor, Farm Shop Practice, Kansas State College, Manhattan, Kansas.*

"There are large numbers of minor mechanical operations in the way of repairs and replacements that can be economically performed with a modest farm work shop. A good many of our farm tools are now built on principles followed in the building of an automobile and it would scarcely be worth while for a farmer to attempt to keep a shop adequately equipped to deal with such machinery. However, there is such a wide discrepancy between farm wages per hour and city mechanics' wages per hour that the farmer can scarcely afford to have city mechanics do many of the simpler repair jobs. A modest repair shop for the simpler jobs would, therefore, seem to be distinctly desirable; while a repair shop with sufficient equipment and skill in operation to make repairs on tractors, combines, and the like would still not seem to be advisable.

"There may be one exception in this last case; namely, for a man who is mechanically inclined, a repair shop where he can do repair work for his neighbors may justify itself. I happen to know of two instances of this sort. In both cases, the investment in the repair shop will run up to more than \$1,000. Such a shop would be out of the question except for the fact that in both of these cases the farmer-mechanic owning the shop and operating a farm is really doing two jobs, part-time farming and running a machine shop."—O. R. JOHNSON, *Professor of Agricultural Economics, University of Missouri, Columbia, Missouri.*

". . . . in general, small farms do less along shop lines than do middle-sized or large farms—small farms being under 100 acres, middle-sized or large farms 100 to 249 acres, and large farms 250 acres and over. Tenants do as much farm work as owners, but it is generally of a temporary nature, such as horse-shoeing, etc. The owner does more in the line of machinery, concrete, etc.

". . . . I would say that more efficient farm shop work is one of the reasons which tend to make a farm a better one. It seems that a farmer can operate his farm more economically if he is trained, has the equipment, and does his own shop work. Studies in farm management show that during the year a great deal of time is wasted on the farm. This time could well be used in shop activities.

"The social implications behind the farmer's shop are tremendous. I believe that shop work is one factor influencing rural living to a great extent. It is one way of keeping boys interested so that they will stay on the farm, and it is a way of retaining their interest after they do stay there. The motivation is there, as most youngsters like to tinker and this answers that problem very nicely From a school point of view, it is quite evident that farmers get a great deal out of their work in machinery repair, etc. If we go on the assumption that we learn to do by doing, farmers certainly get a lot in the line of education from the mechanical work which they do."—CARLTON E. WRIGHT, *In charge, Applied Farming Course, University of New Hampshire, Durham, New Hampshire.*

". . . . I have operated a farm of my own for several years and know the value of a shop from personal experience. I find that it saves considerable time in going back and forth to a shop elsewhere, and that labor is also less. I have a man employed on the farm who is handy with tools and he can do much of the work of this kind when other jobs are not pressing. It also helps him by enabling me to provide him with more regular employment. I also permit him to use the shop to do jobs for the



Students of vocational agriculture engage in a wide range of farm shop activities. The above picture shows a group from the Oakhurst High School, Mecklenburg County, erecting a colony hog house as a class project. This class, working under the supervision of C. J. Lawrence, teacher of agriculture, drew the plans for the building, calculated the bill of materials, and did the construction work. Many farm boys of the State are learning to do the simpler repair and construction jobs on their farms through actual experience.

neighbors, when our own work is not pressing, for which he receives the entire amount paid.”—CHARLES E. ALLRED, *Head, Department of Agricultural Economics and Rural Sociology, University of Tennessee, Knoxville, Tennessee.*

“I believe that practically every farmer above the status of half share-cropper has a few shop tools with which to work and a place where he usually uses them. This may be at a block of wood in the shade of a tree, on a back porch, in the shed of a barn, or even an especially constructed shop.

“Values from shop use might be: (1) saving cash outlay; (2) saving through elimination of the necessity of travelling some distance to the shop in a busy season; (3) saving “waste” time in rainy or bad weather when most shop work should be done; (4) permitting the doing of a job when it should be done (5) making or adjusting tools and equipment to fill more adequately the farm needs and (6) providing certain tools that cannot be bought which, nevertheless, may be needed on a particular farm. In addition, some farmers may earn cash by servicing neighbor’s tools or doing other odd jobs with the shop equipment.”—BEN F. ALVORD, *Head, Department of Agricultural Economics, Alabama Polytechnic Institute, Auburn, Alabama.*

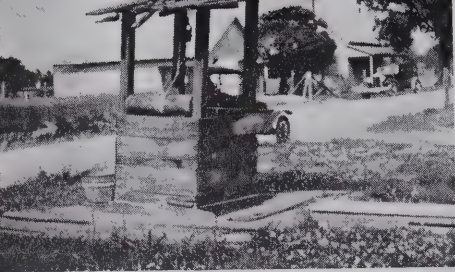
SUMMARY

1. Studies in Louisiana show that farmers who are prepared to do their own farm shop work save annually from \$20 to \$24 on small farms in the upland cotton area and about \$80 on the larger farms.
2. George B. Byers and B. T. Inman, authors of the Kentucky Experiment Station Bulletin 345, “The Use and Expense of Farm Implements”,

found that repair shops made savings of \$5.47 in expense for each \$100 of implement investment.

3. In their baccalaureate theses "A Study of the Home Farm Shop in Relation to Needs in Specific Areas in Indiana," Leonard Kingsley and Clarence Creager found:
 - a. That a majority of the farms in Indiana lack suitable tools and equipment and shop buildings to do adequate farm shop work (1) that vocational agriculture training had a direct influence upon the type and quality of shops found on these farms and (2) that electrical and mechanical power were on the increase on Indiana farms.
4. Observations and findings by other agricultural leaders on the value of farm shop work towards the successful operation of the farm are:
 - a. That the more successful farmers have some sort of place or building in which to do farm repair and construction work.
 - b. That the skill possessed by the farmer and his family in farm shop jobs is directly correlated with income on the farm.
 - c. That "a good farm shop will encourage many farm boys to stay on the farm as it gives them an outlet for the urge every boy has to work with tools."
 - d. A good foundation in the use of tools which many farm boys have obtained in farm shops has enabled them to adapt themselves to changing conditions which confront them after leaving the farm.
 - e. Minor mechanical operations in the way of repairs, construction and replacements can be economically performed with a modest farm work shop.
 - f. Farm shop work is an important factor towards the improvement of rural living standards.
 - g. A farmer who has the ability and actually does his simpler farm shop work saves (1) in cash outlay; (2) saves "waste" time in rainy or bad weather when most shop work is done; (3) saves by doing an emergency shop job in the rush season; (4) saves by adjusting and adapting tools and equipment to fit the farm needs better; (5) saves by providing certain tools and appliances which cannot be bought but which may be needed to do a particular job; and (6) saves time in doing the job at home that otherwise would require travel and expense to have it done away from the farm.

Research on the Values of Farm Shop Work Should be Extended.—It is evident from the survey made that only a limited amount of research has been undertaken to determine the values of a farm shop program, economic or otherwise. However, this brief summary of the values of farm shop work, as evidenced by the limited research already done and by the opinions of certain agricultural economists and others, indicates that teachers of vocational agriculture are justified in devoting their time and effort towards a more effective program. Further studies should be made to determine more fully the values of such a program, especially in the light of the present rapid trend of increasing shop work in the rural schools as a part of the vocational agriculture course.



Nothing is Very Permanent on the Average Farm.—The old well curb at the barn may be in good condition today; tomorrow it is in need of repair.



The roof to the house may be repaired today; tomorrow it will need other repairs. A piece of weatherboarding will need to be replaced, the blinds will need readjusting, and a fresh coat of paint will need to be added.



The back door steps will need to be replaced or the porch floor will need repairing.



The shed to the barn may be new today but it soon begins to tumble down if not kept in repair.



Even the new hay rake will need a new tooth. Other similar problems of repair and maintenance of farm equipment are constant on the farm. The farm fence may be broken down by cattle; the gate may rot off its hinges; the plowstock may break; the tongue in the wagon, grain drill or mower, may split; the cuff may slip off the double-tree; the watering trough may spring a leak or dozens of other shop problems may arise. Such things take place on all busy farms, creating needs for repair, construction and general maintenance from day to day.

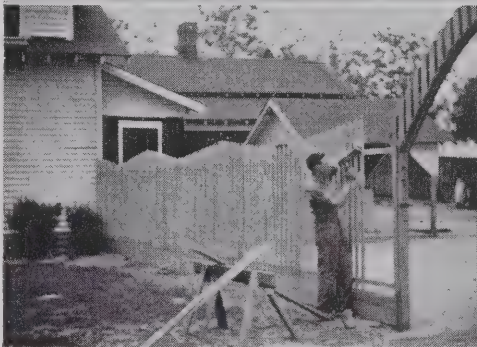
**Students of Vocational Agriculture
Should be Trained to Maintain and Im-
prove Their Home and Farm Equipment.**

—The simpler farm improvements, if made, are usually made by the owner or operator. Pictures at the right show students of vocational agriculture from the class of the Fuquay Springs High School, Wake County, doing simple construction and repair work on their home farms. Reading from top downward they are Allen Partin, senior, building a new furnace in a tobacco barn; Roy Baucom, repairing the back door steps; Carey Powell building a lattice fence to screen the backyard. He has previously improved the front lawn by sowing grass seed and setting shrubbery. The lattice fence completes his initial work on his home improvement project. Ben Weeks, a ninth grade student, repairs a lawn mower and stops a leaking water spigot.

Farm boys are being trained today to do these and many other shop jobs more efficiently. They get practice at school and at home in doing these things under the supervision of teachers of vocational agriculture—the things they are going to have to do anyway, if they are done.

It is significant that in making long term farm mortgage loans in North Carolina, credit agencies find it necessary to *require* that an appreciable portion of the loan funds be used in making minor repairs to farm buildings, such as repairing porches, reroofing houses, repairing weatherboarding of barns, and rebuilding steps, pillars and chimney flues. Most of these repairs could and should be done by the owners or operators of these farms.

Farmers of the South when properly trained do not need to employ high priced mechanics to do their simpler repair and construction work.





The above picture shows students of vocational agriculture at work in the Leggetts High School shop, Edgecombe County. This is one of more than three hundred vocational agriculture shops now provided in the public rural high schools of the State.

THE RURAL SCHOOL AND THE FARM SHOP PROGRAM OF ACTIVITIES

A Rural School, Among Other Things, Should Deal with the Real Problems of the People in its Area.—The activities of the school and the activities of the people should be drawn as closely together as possible.

A rural school serving primarily farm people has a definite responsibility for guiding its students, young and old, in developing appropriate abilities for meeting their daily farm problems. How shall we ever improve conditions in the farm home and on the farm until we employ in the school a program of activities based on problems drawn directly from the home, the farm, and the community?

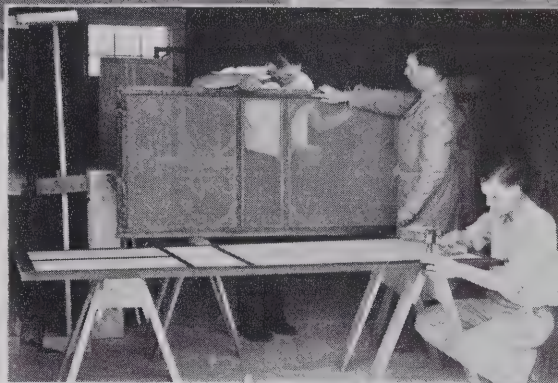
Shop practices in such a school should be drawn from the actual repair and construction jobs necessary for maintaining and improving the farm home, the farm landscape, the farm buildings, and the simpler farm equipment used on these farms in such degree as these practices are appropriate to the concern and maturity of the individual.

Such an organization of method calls for supervision of student shop work and practice at the school, in the home, and on the farm. Such a program, if vital, must also be organized around the needs of the individual and around problems directly related to his interests. Individual shop problems and practices should therefore be based upon and projected from the student's actual problems as a farm worker or homemaker.



Activities in the Rural School Shop Should Relate to Activities in the Home and on the Farm.—The picture above shows a group of students in the Fuquay Springs School shop, Wake County, constructing a self-feeder for a student's hog project, lawn furniture, feed boxes, and other devices for their homes and farms.

T. A. Whitehurst, a senior in the Stokes High School, Pitt County, is shown in the upper right picture hanging the last of twenty-two screens on the dwelling of his uncle with whom he lives. He made all of the screens at the Stokes school shop, hauled them home and installed them under the supervision of his teacher of agriculture, G. M. Britt.



The next picture below shows R. B. Winchester, teacher of agriculture at the Mount Gilead High School, Montgomery County, inspecting two screen doors being completed by J. C. Thompson and Marion Lefler, two of his students, for their homes.

The lower picture shows the beautiful landscape of Mrs. B. G. Bunn's home in the Saratoga school community. George Sturgeon, teacher of agriculture, is shown with one of his students studying the furniture on her lawn.

These shop activities are only a few of the many that may be appropriately selected by students for their shop practice either at school or at home.

There is no phase of the program of vocational education in agriculture which offers greater opportunity for individual instruction and guidance than the farm shop program properly organized and supervised. Each individual should be free to progress from one skill to another, from one problem to another and from one body of related information to another at his rate of acquired skills and interest.

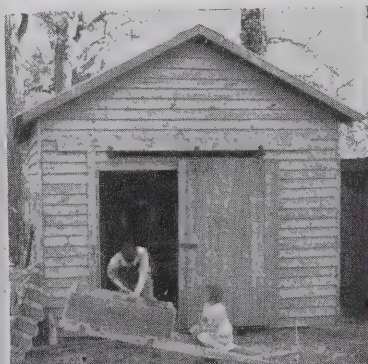
As students advance with their skills, they can undertake more complex repair and construction jobs. There are plenty of jobs to be done. The wide-awake teacher will guide his students in selecting such jobs as are within their individual range of ability to undertake and do.

Improvements of rural standards of living in the South will not come by increased income alone. There must be a change in the attitudes and skills of its people. Rural people with low incomes must learn to do more things for themselves. Rural schools, as they are now being more adequately equipped, should provide definite training to this end.

We shall never improve our rural homes and farms until we devote more and more of our school activities to projects drawn directly from the activities necessary for improving these homes and farms. Increased emphasis on the development of mechanical skills and related science has a definite, tangible place in such a program of rural betterment.

To be thrown upon one's own resources is to be cast into the very lap of fortune, for our faculties then undergo a development and display an energy of which they were previously unsusceptible.—FRANKLIN.

Students of Vocational Agriculture Learn to Accomplish for Themselves.
—“I did not have enough money at the time to buy a drill press, so I built this one from the front part of a bicycle frame and an old breast drill,” was the proud remark of Aumon Parrish, left, student of the Lowe's Grove shop class, Durham County, when the writer asked him what it was. Aumon had “invented” something that worked, and really worked well. He was somewhat surprised and much pleased at what he had done alone on his own resources. He had taken the mystery out of the drill press by his own initiative and skill. He had accomplished in his own right. His self-confidence and faith in himself had been increased. He had learned a great lesson—to be master of his own problems.



Aumon Parrish “invents” a drill press on his own initiative.

Ralph Brake finishes up a farm cart in front of his home shop while his proud little sister looks on.

Ralph Brake, at the right, student of the Leggetts shop class, Edgecombe County, is putting his cart to practical use in hauling a bag of feed to his hog lot where he has several hogs on self-feeder. "I made this cart myself," Ralph remarked when asked what were some of the things he did in his home shop. Yes, he too had discovered a thrill over his accomplishment. He had created something useful and vital to his everyday living; he had in this way discovered an ability which he previously did not know he had.



The middle picture to the right shows Parks Godwin, Mount Gilead High School student, Montgomery County, tightening a nut on his first plowstock while his teacher, R. B. Winchester, steadies it for him.



The lower picture shows Paul Partin, Leggetts High School, Edgecombe County, setting the mandrel of a wood saw in a new bearing he has poured.

The faculties of all these boys are undergoing a development and displaying energies "of which they were previously unsusceptible." *Their discovery of their ability to do these things is a hundred times more important than the things they make.* Happy indeed is the person who first discovers a fuller living by his own works. Many a farm boy is making this discovery through shop practice at school and at home. Aside from its economic value, farm shop work is an important tool for learning. For individuals who especially like to do things, it is perhaps their very best device for learning.

"We judge ourselves by what we feel capable of doing, while others judge us by what we have already done."—LONGFELLOW.





A Few of The More Skilled Students of Vocational Agriculture Build Finished Articles for Their Homes.—Milton and Irvin Cherry, above, place in their home kitchen a large kitchen cabinet which they built at the Leggetts High School shop, Edgecombe County, under the supervision of H. N. Cherry, teacher of agriculture.

Alfred Ballard, upper left, a student in the farm shop class at the Mount Gilead High School, Montgomery County, puts the finishing touches on a cedar wardrobe for his bedroom at home. Lewis Ingold of the same class is finishing up a cedar chest for his home. Only the more skilled students should undertake jobs of this type. The red cedar used in these jobs is native to the community and readily available at low cost.

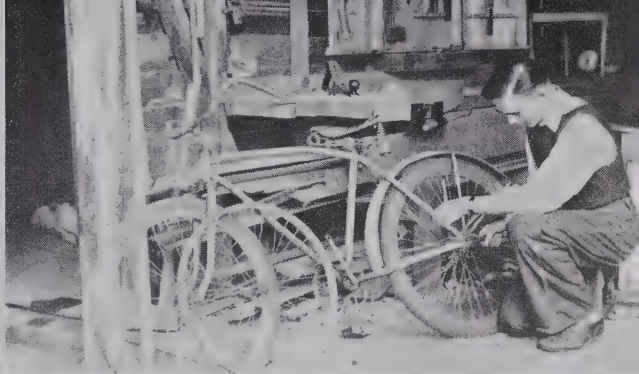
The students of vocational agriculture at the Mount Gilead High School completed 415 construction and repair jobs at the school shop during the school year, 1938-1939. Chief among the jobs done at the school were repairing and sharpening 163 hand tools such as hatchets, axes, butcher knives, bush axes, saws, chisels, plane bits, draw knives, and plow sweeps; repairing and refinishing a total of twenty-five chairs, tables, desks, chests; constructing 227 articles such as tool cabinets, plow stocks, wheelbarrows, cedar chests, screen doors, ironing boards, wardrobes, bookcases, tables, medicine cabinets, singletrees, doubletrees, hammer handles, nail boxes, and a few others.

In addition to the shop work done at the school shop, most of the students did many more jobs at their homes. Alfred Ballard, a tenth grade student shown in the above picture finishing his cedar wardrobe at school, did in addition the following shop jobs at home during his three years in high school: built a house for capons, a flower box for the porch, a chicken coop, a wash bench, a beehive, and a potato storage place; repaired and screened a window; made and installed handles in a hoe, plow, pitch fork, shovel, hammer; hung a door and repaired chairs for the home.

R. B. Winchester, teacher of agriculture at the Mount Gilead school, said, "Our boys spend part of their spare time during the school day noon-hour and often after school in the school shop, in addition to their regular shop schedule of ninety minutes a week.

"In addition to the many simpler repair jobs they have, in the past five years, constructed and placed in their homes in this community more than seventy-five cedar chests and wardrobes. The school shop was kept open four Saturdays during the summer so they could come in and do shop work under my supervision.

"Most of our farms are small and we have not attempted very much work on farm machinery repair. Our shop has recently been enlarged and we are now preparing to do more of this type of work. However, in a consolidated school where most of the students are transported to and from school, it has not been practical to do this type of repair work on the school grounds."



*"Unless a man gets joy from his work,
he will produce nothing worthwhile."*

—GEORGE GREY BARNARD.

**Students of Vocational Agriculture
Work on Problems of Vital Interest to
them in Their Home and School Shops.**

—Junior Broadway, Cleveland High
School student, Salisbury, route 1,
shown at upper left is happily turning

out a leg for a footstool he is constructing for his living room. While the stool itself may be of little importance, Junior finds much joy in working on it and other appliances for his home. He has a well equipped farm shop where he spends his rainy days, many evenings and other spare time working—developing many useful skills. This shop contributes much to his fuller living on the farm. P. H. Satterwhite is his teacher.

Billy Hardison, Stokes High School student, Pitt County, upper right, also finds much joy in working in his home shop established under the supervision of G. M. Britt, teacher of agriculture. His bicycle is as vital to him as an automobile is to an adult. Why not learn to repair it? He has learned, and he has made many conveniences about the home.

The shop program of these two boys and many other farm boys of the State consists of definite shop instruction at school with follow-up practice in the home shop and on the farm under the direction of their teacher of agriculture. They work many hours on problems of direct concern to them. Are they learning to do construction and repair work? A visit to their homes and a short talk with them will convince you that they are.

A good approach to sound shop methods of teaching is to take into account both the needs and interests of the individual. *The individual is the teacher's concern.* The good shop teacher finds and uses the interests of his students to guide them in mapping out their shop program.



Farmers Return to Their Local School Shop and Continue "In School."—Edward P. Holloway shown in picture at the left is one of a group of thirty-two young farmers who attend a shop night class in Middleburg and work under the direction of their teacher of agriculture, George B. Blum. A majority of these young men

are Mr. Blum's former students who had high school shop training. They now return to the school once a week at night during winter months to repair and construct farm and home appliances. During the months of January, February, March, and April, 1939, they brought to the school shop and repaired seventy plows and six wagons; sharpened twenty-two hand saws, fourteen timber saws, three circular saws, and thirty-nine hand tools; constructed one kitchen cabinet, four terrace drags, three end-tables, one two-row horsedrawn tobacco hill spacer, and several other smaller articles, all for their homes and farms.

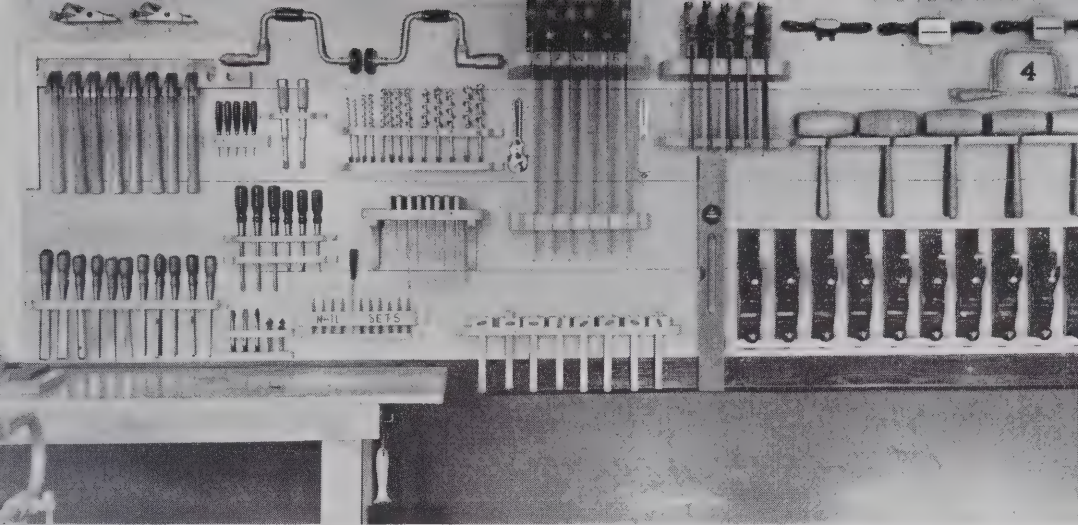
The whole group made a special study of the home repair of the simpler electrical appliances, the care and operation of power tools, and the cutting of rafters and steps in addition to their individual work. Many other farm problems were discussed in other separate meetings.

The group was divided into two sections, one section meeting Monday nights, and the other section, Thursday nights.

The Middleburg school shop thus serves both as a community service center and as an educational institution for out of school groups. Adults of the community continue "in school," studying and working on problems of vital interest and need to them. They improve their homes and their farms through their own study and efforts.

The activities of these people and the activities of the school are brought closely together. To them, learning and living continue the same vital thing.

With increased shop equipment a majority of the vocational agriculture shops of the State can now be more effectually used in a broader program of education for farm boys in school, young farmers out of school, and adult farmers of the communities they serve.



A compact arrangement of tools on an open panel as provided in the industrial education shop at the Wadesboro High School, Anson County.

SELECTING AND ARRANGING EQUIPMENT FOR THE VOCATIONAL AGRICULTURE SHOP

Racking Tools.—An orderly arrangement of tools is very desirable in school shops where a number of different individuals use the same tools. Several different methods are in use in the North Carolina school shops. Many devices for racking the tools are also in use.

There are three principal methods of racking the tools: the wall-display panel, the wall cabinet, and the toolroom.

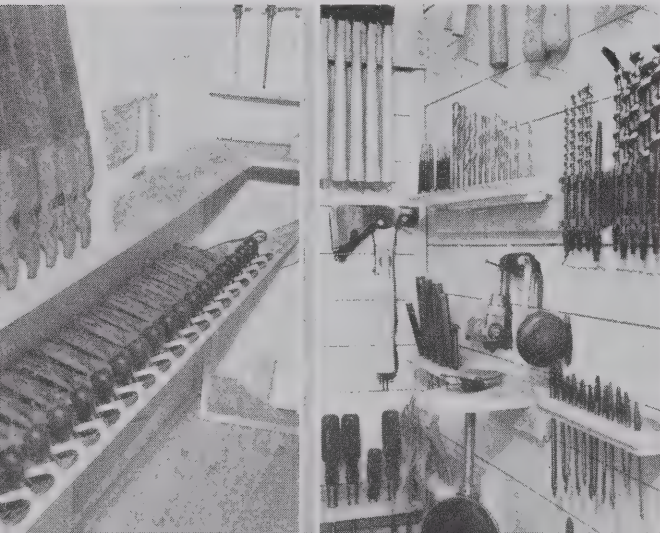
The **Wall-Display Panel** is a very convenient method. Panels, large or small, may be arranged over or near the work benches in easy reach of the worker. Tools for different types of work, such as woodwork, metalwork, soldering, etc., may be conveniently racked on separate panels nearest where each type of work is to be done. Such a method is very desirable from the standpoint of saving the students' time, for providing an easy method of checking the tools after each class, and for reducing to a minimum confusion in securing the tools by students. However, this method makes the tools readily accessible to each and every person that enters the shop through door or window and has not proven practical in schools with large shop enrollments because of the heavy loss of tools from misplacement and at times from theft. Although this method of racking tools is not recommended for the vocational agriculture shop, it offers excellent suggestions on how to arrange the tools orderly and compactly in wall cabinets or on walls in the tool room. The panel on this page as used in the Wadesboro High School is an excellent example of this method of racking.

The Wall-Cabinet Method.—A good type of wall cabinet for racking tools above the woodworking bench is shown on page 28. At least one cabinet of this type should be installed in the school shop as part of a suggested home shop unit. (See the suggested shop plan on page 26.) It is a good type for use in the home shop in that it will hold one each of the kind of hand tools necessary for doing the usual repair and construction work on the farm. This cabinet when opened forms a broad "wall panel" of tools racked in plain view and in easy reaching distance of the worker. When closed it protects the tools from excess dust and moisture. If locked, it offers reasonable protection from misplacement or theft of tools.

A set of tools appropriate for the student's home farm shop should be carefully racked in this cabinet as a demonstration for the students. The inset at the top of the illustration shows how the cabinet may be silhouetted to show tool placement. The inset at the bottom shows a similar cabinet filled with tools. The particular design of arrangement should vary with the number and kind of tools to be racked. Over one hundred tools may be racked in this cabinet if they are carefully placed.

A number of schools are racking all tools in several cabinets of this type rather than in a central tool room. Where there is sufficient duplication in the kinds of tools this method is very desirable in that tools so racked are more convenient to students. However, this method makes the tools more readily accessible to theft than a securely barred and locked tool room.

The Tool Room Method.—This method is used more generally than any other in this State. When this method is used, a careful plan for racking all of the tools should be made before any of the tools are racked. With careful planning all tools of one kind can be arranged together forming compact groups in separate racks for easy checking and daily observation. They may be racked on the walls, in cabinets, or on shelves. A neat, orderly design which will place each tool in plain view should be planned and carried out. The hidden tool is usually discovered full of rust.



Tools racked in central tool rooms should be compactly arranged to conserve wall and shelf space. All tools should be in plain view so they can be easily checked and their condition observed from day to day.

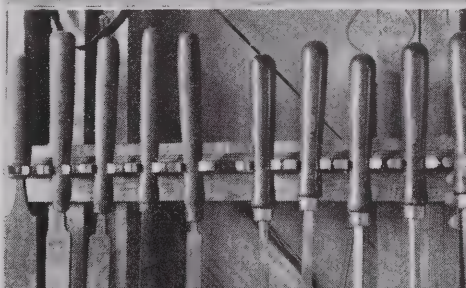
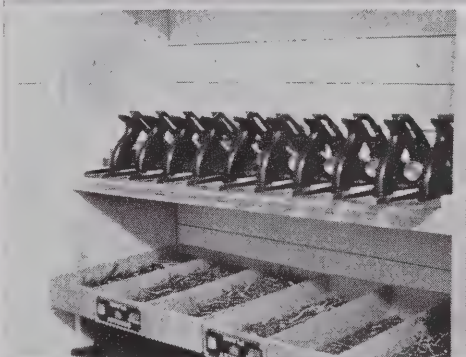
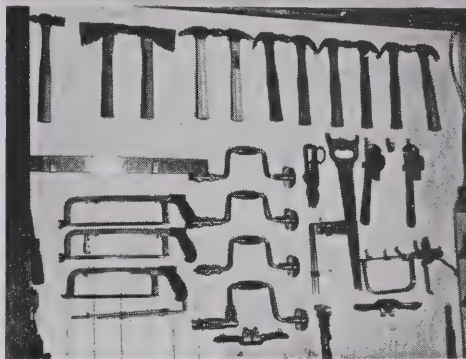
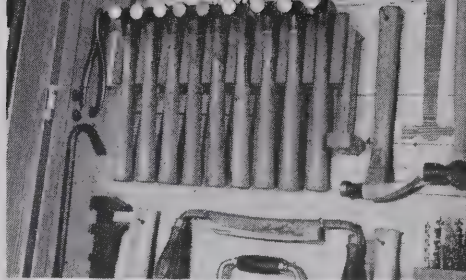
Special Tool Racks.—Hammers can easily be arranged in an orderly, compact space as shown at right. A one-inch by four-inch board is set on brackets one inch from the wall or back of the cabinet. The hammers are spaced by tacking three-quarter inch strips between them. Hang as shown.

Note the difference in the wall space required on this panel and the arrangement above. Wall space is important in the shop. Generally, it is best to rack a tool with the wide side perpendicular to the wall—framing squares and braces excepted.

Racking saws with the teeth outward may result in injury to either saw or worker. Rack with teeth against wall as shown in the picture to the right. Safety cannot be over-emphasized in the shop.

Racking jack planes on level shelves with face flat and bits forward is not a good practice. See the cut on page 24. Here the planes are resting on an inclined shelf made of two boards spaced three inches apart, so that the points of the plane bits will not touch. The plane slides backwards into the rack.

Adjustable clips may be used for racking the smaller tools, such as chisels, screw drivers, etc. They are now for sale by the leading hardware stores and tool dealers. Open drop holes in wood strips serve the same purpose. See Roehl's Farmers Shop Book for additional suggestions on how to rack tools.



A suggested plan for arranging school shop equipment shown by the drawing at the right was made to conform to the latest general suggested building plans available from the Division of School House Planning, State Department of Public Instruction. Separate workbenches are suggested here in place of the one, long wall bench. Either type is very satisfactory. The separate benches provide an opportunity to group together at times for the repair and construction of window and door screens and similar work.

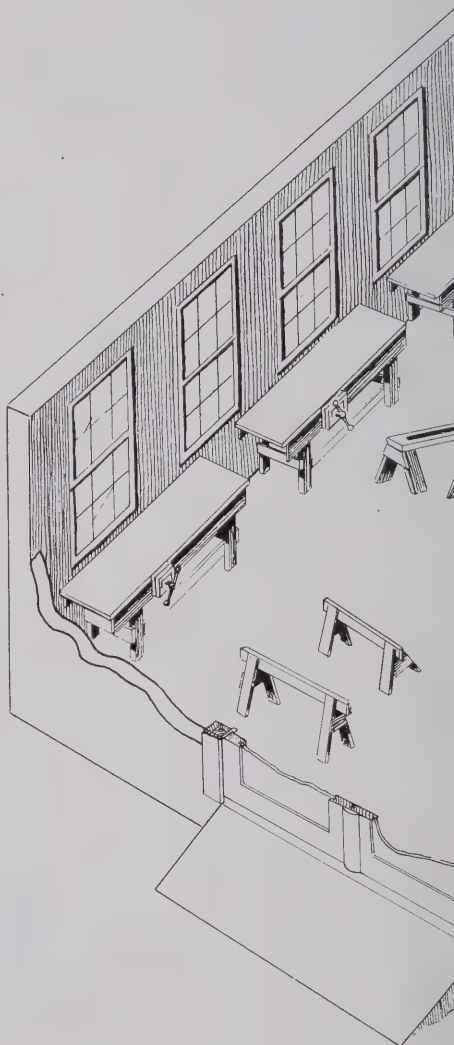
Note the home shop unit consisting of a tool cabinet and workbench at the end next to the paint and storage room. Almost any farm boy can provide this simple equipment and a place under a shed somewhere on the farm to do farm shop work. This unit is suggested to serve as a demonstration for this purpose as well as for use in the school shop.

It was not possible to show all the appropriate accessory and other supply cabinets which are suggested elsewhere in this bulletin, for lack of visible wall space to the right of the shop room and the interior of the paint and storage room and tool room.

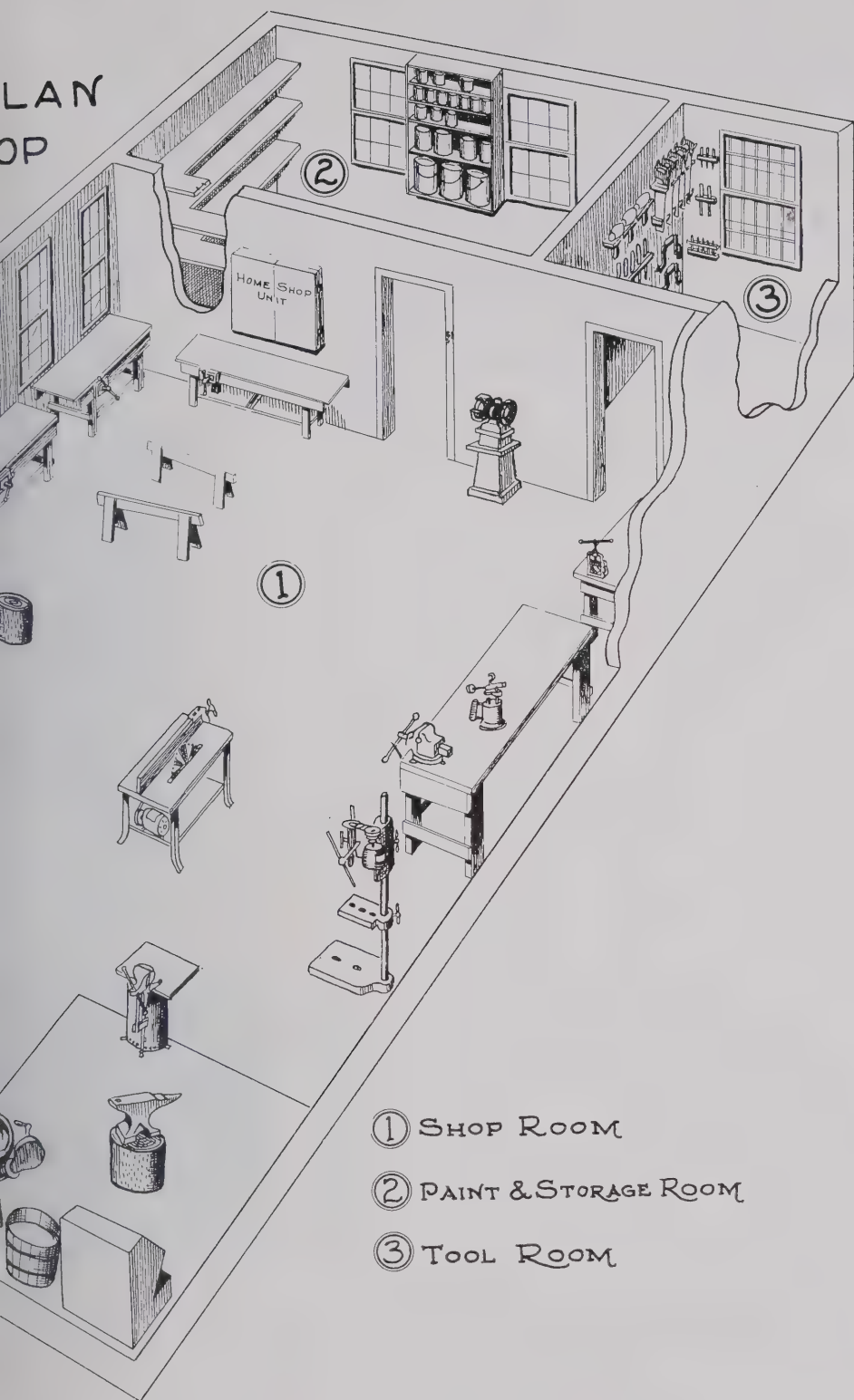
The approach to the double entrance should be provided with a gradual slope by filling in with dirt. It should have a more gradual slope than is shown by the drawing.

See details for the bench, for the tool cabinet, and for storing tools elsewhere in this bulletin.

A SUGGESTED FOR ARRANGING EQUIPMENT



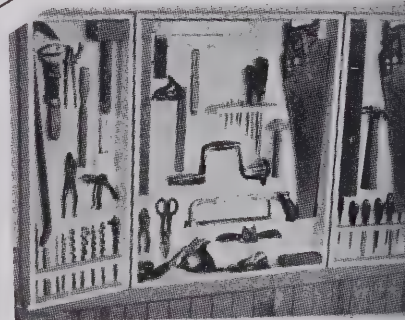
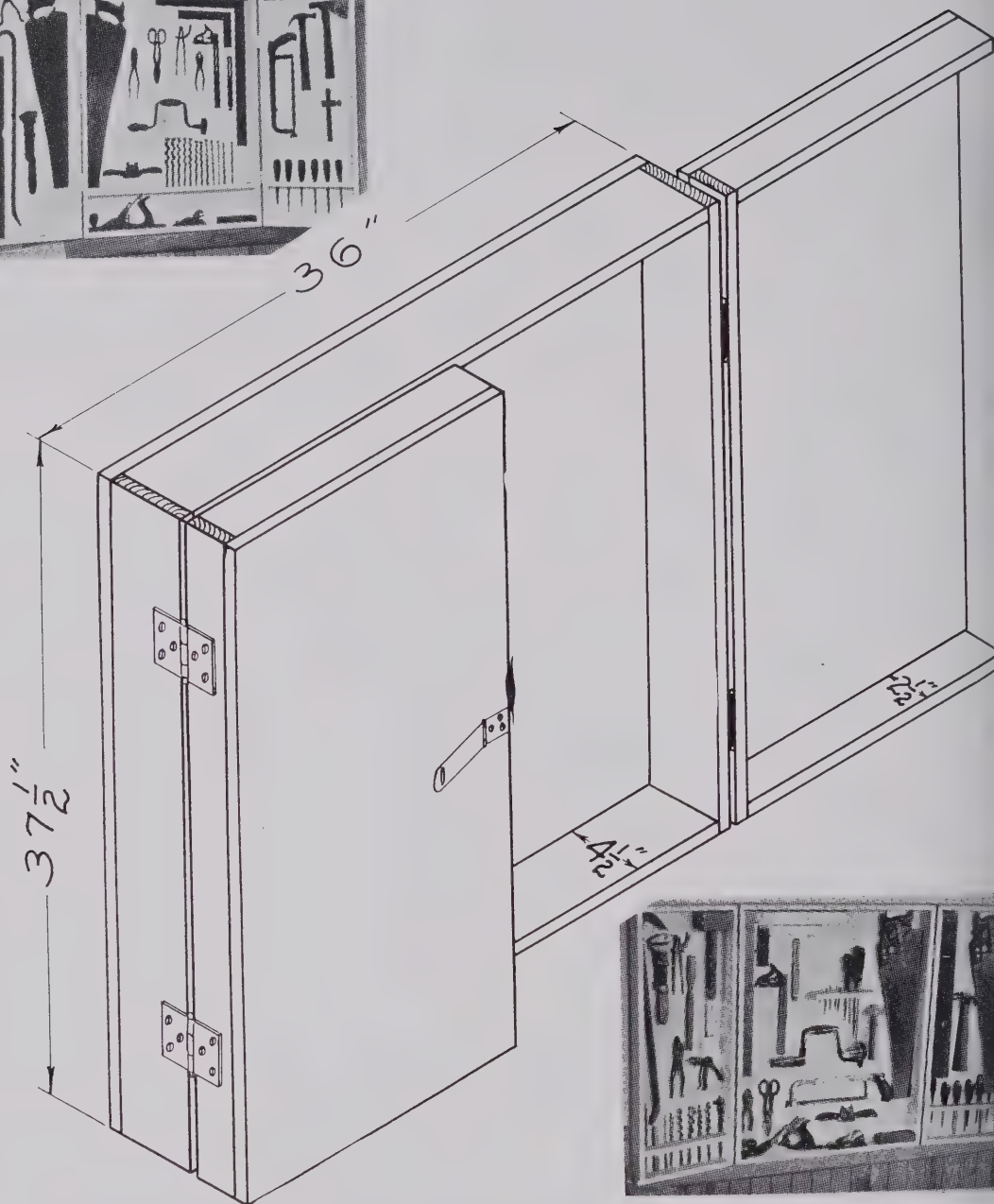
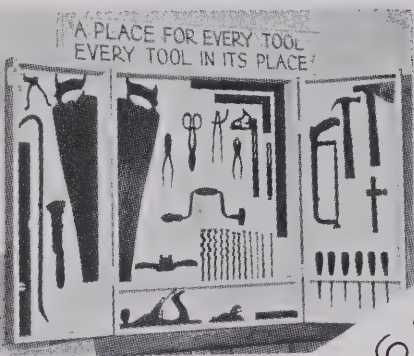
PLAN
SHOP



① SHOP ROOM

② PAINT & STORAGE ROOM

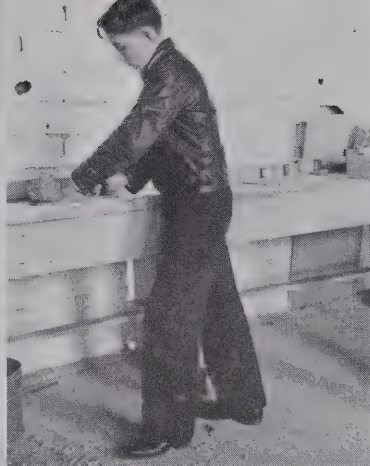
③ TOOL ROOM



A good type tool cabinet for the school or home shop. This type of cabinet attached to the wall just above the workbench provides easy access to a complete set of tools for general repair and construction work. More than one hundred hand tools may be compactly arranged in this cabinet. The condition of the tools is under the daily observation of the worker. Rust, a constant enemy of tools, can easily be discovered on tools so arranged. The alert worker will remove the rust before much damage is done.



BENCH TOO HIGH



BENCH RIGHT HEIGHT



BENCH TOO LOW

Benches of different heights should be installed in school shops to meet the needs of students. The above pictures show three different students working at the same bench. The height of the bench is $32\frac{1}{2}$ ". The heights of the boys, reading left to right, are 63", 67", and 75", respectively. Benches for high school students should range from 30" to 35" in height.

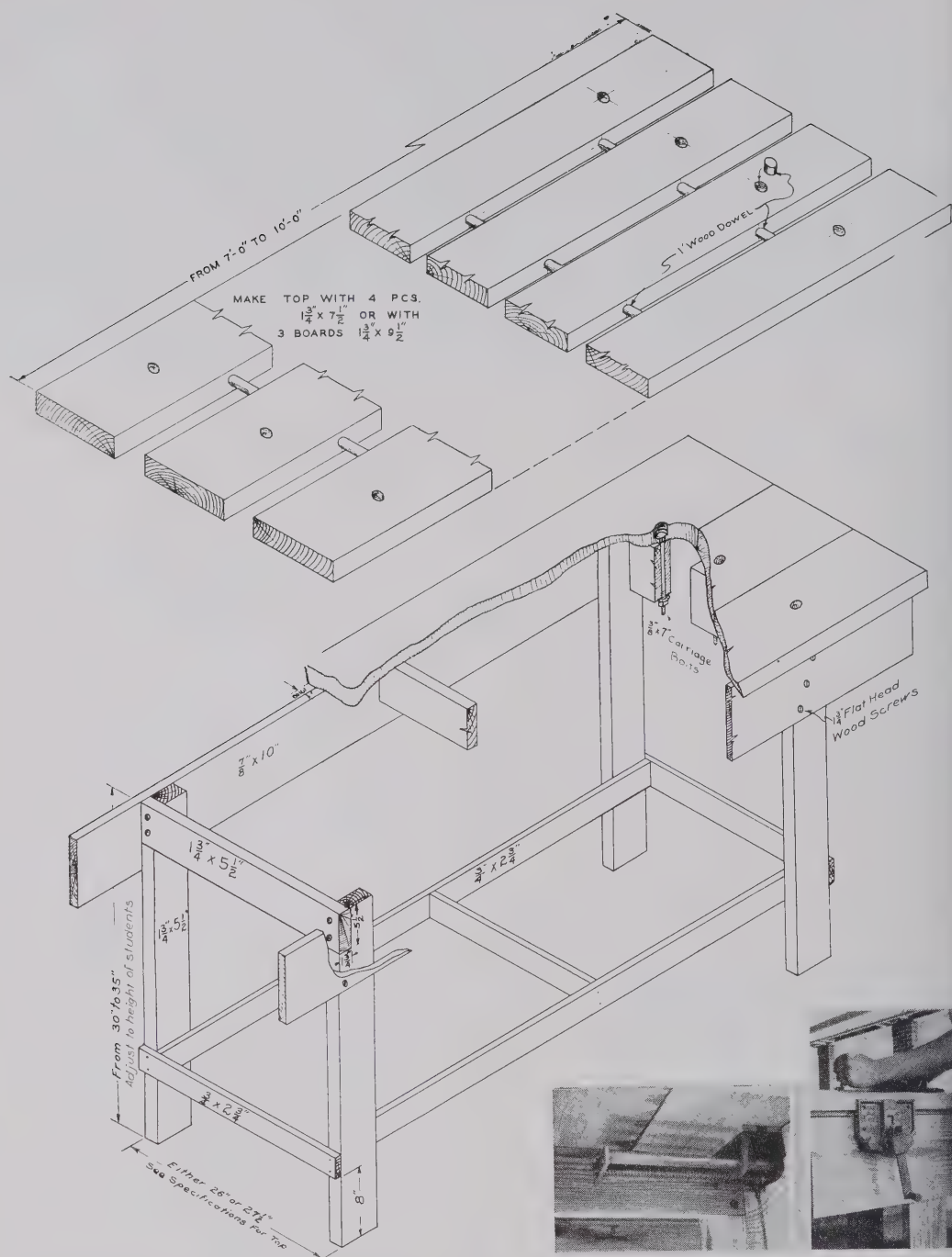
Woodworking Bench for the Vocational Agriculture Shop.—Specifications for a good woodworking bench are given on the next page. The legs and sills are made of $1\frac{3}{4}$ " x $5\frac{1}{2}$ " boards; the leg braces are of $\frac{3}{4}$ " x $2\frac{3}{4}$ " boards and the top either of three or of four boards $1\frac{3}{4}$ " thick of regular finished stock widths $7\frac{1}{2}$ " or $9\frac{1}{2}$ "—all thoroughly air dried or kiln dried. At least the front top board should be of hard wood.

The bench should range from 30" to 35" high and from 8' to 10' in length. Lengths of the benches should be adjusted to fit best the dimensions of the shop room. The height of the benches should vary for groups of students of different heights. For example, if there are six eight-foot benches in a shop, build two 32" high, two 34" high and one each 30" and 35" high.

The top boards should be accurately fitted, doweled and glued with cold water glue to form a rigid, smooth top. The top, after being put together, should be bolted to the sills with $\frac{3}{8}$ " x 7" carriage bolts. The heads of the bolts should be counter-sunk and dowels inserted as indicated. The edges of the top should project over the aprons $\frac{3}{8}$ " front and back.

Install the *Columbian No. 5CDS vise—4" x 7" jaw as listed on page four in our department mimeograph circular No. 29, September, 1939, entitled "Supplies and Equipment." See inset pictures on the next page for illustrations of vise installed. The top of the vise jaws should be flush with the top of the bench. The frame of the vise fits under the front top board and is bolted on. Sometimes it is necessary to add a block between the under side of the top board and the frame of the vise to adjust the top of jaws flush with the top of the bench. The heads of the bolts should be counter sunk three-quarters of an inch from top surface and the holes filled with dowels.

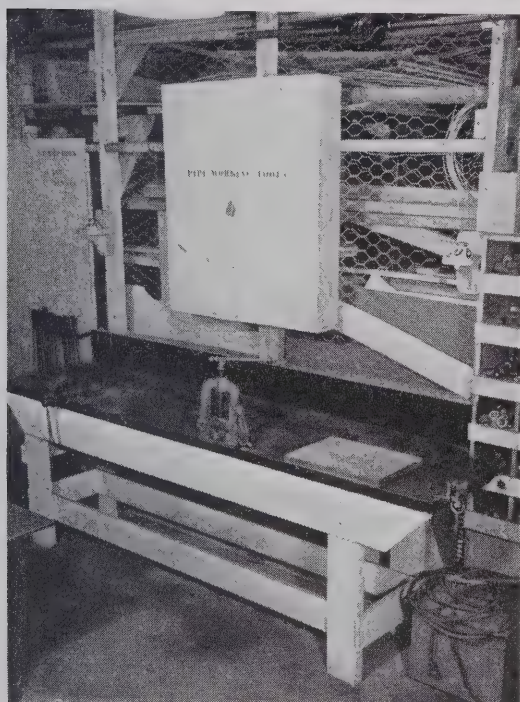
*This is specified at present under State contract.



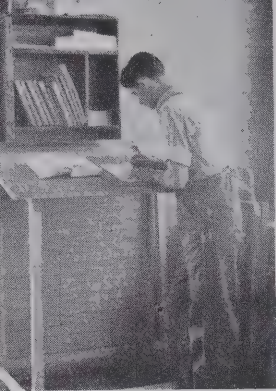
The frame and top of the woodworking bench should be assembled with carriage bolts to insure a firm structure. The top should be reasonably heavy and constructed to prevent warping and to provide a smooth, level surface. No metal should be exposed in the top surface. The length of the benches should be adjusted so the desired number will fit the dimensions of the shop.



The bench top for soldering work should be covered with sheet metal. The above unit consists of a metal covered bench, a supply cabinet and an assortment of soldering equipment for farm soldering work. This is a well arranged unit for the vocational agriculture shop.



A practical workbench and tool cabinet for pipe fitting and farm service plumbing equipment is shown at the left. This unit is in use in the farm shop at State College but is appropriate for use in rural school shops. The bench is constructed similar to the woodworking benches described elsewhere in this bulletin. It is equipped with a machinist's vise, two pipe vises, and a heavy flat iron anvil. The top is painted black.



Miscellaneous Equipment.—A combination table and drawing board should be available to students in every shop. This may be located in the main shop room or in the small paint room adjoining the main shop. A book rack for basic references should be installed above the drawing table.



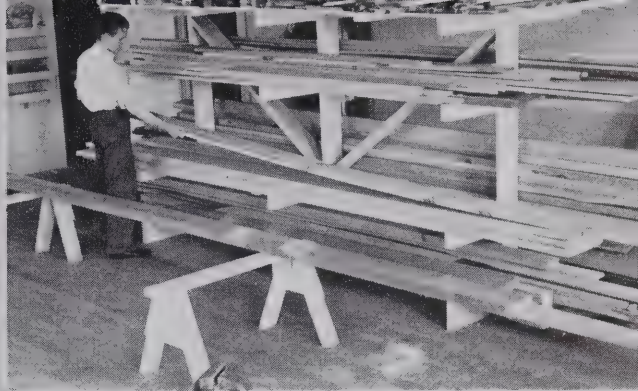
At least one chopping block should be available in every school shop. This humble piece of equipment can usually be secured by a student who is willing to cut it from his home forest. It should be at least eighteen inches in diameter and about twenty inches high. Care should be taken to saw the block square at each end.



Hot metal work is not very important in some communities. School shops located in these communities should be provided with facilities for doing cold metal work. An anvil mounted as shown at left is a very necessary piece of equipment for these shops. See page 45 in this bulletin for a list of tools suggested for cold metal work.



A trash box mounted on short legs with coasters is essential for good housekeeping. It can be rolled about over the floor to receive shavings and other sweepings. When full it may be emptied by the school janitor or students.



Lumber Racks.—Racking lumber in the school shop is always a problem for the shop teacher where separate adequate space is not provided outside of the shop room. Two methods are shown above. The picture at the left shows the type used in the industrial

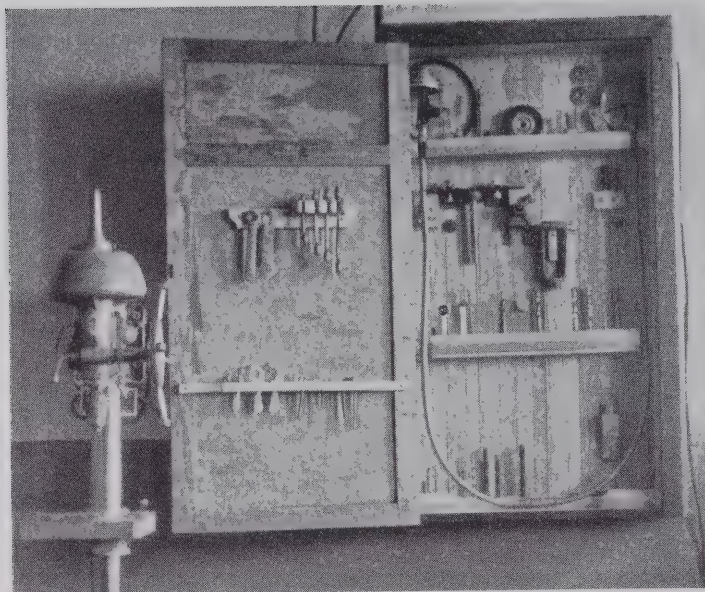
shop of the Durham High School and the one at the right, the type used in the vocational agriculture shop at the Dunn High School. Both require about the same floor and wall space. However, the one at the left provides more shelf space.

The latest specifications for the vocational agriculture shop, available from the State Department of Public Instruction, provides for lumber storage in the attic over the classroom adjoining the shop room. Such an arrangement insures an adequate dry place for storing a year's supply. Lumber is brought down from the "loft" as needed.

Many schools provide shop space in the basement. Lumber storage in the average basement is very unsatisfactory, owing to the usual excess of moisture.

A handy wet grinder for the school shop, when installed on the wall with a small motor above as shown, requires little floor space. A grinder of this type is especially appropriate for inexperienced students to use in sharpening small hand tools.





Accessories for power tools should be racked conveniently in a supply cabinet within easy reach of the operator, if possible. The above picture shows a good arrangement for drill press accessories.

Small corner cabinets are convenient for classifying and storing general supplies. The picture to the right shows a supply cabinet for storing sand paper, emery cloth, steel wool, sanding blocks and dust rags. Note the separate compartments for the different grades of sand paper and other articles. Other general supplies should have some definite and convenient storage space in the shop.

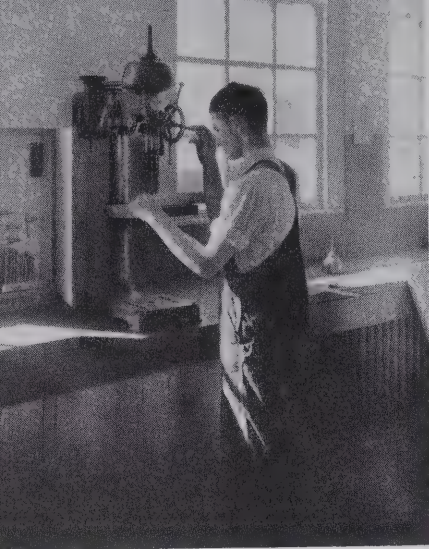




A first aid cabinet with supplies for emergency treatment of wounds should be conveniently located in every school shop. First aid should be administered immediately regardless of how trivial the accident. For a list of suggested first aid supplies see page six of "Safety Education for Shop Teachers in North Carolina Schools," Bulletin 2, Division of Teacher Training, State College Station, Raleigh, North Carolina.



A small open case for racking paints, stains, glues, and a limited amount of cleaning and polishing materials is convenient in the paint room if such a room is available. Fruit jars, carefully labelled, are practical containers for liquids, pumice stone, and similar supplies.



Power Tools.—There has been a rapid addition of power tools to the school shop equipment in North Carolina during the past few years. More than half of the vocational agriculture shops are now equipped with one or more power tools. With the recent development of rural electrification and the production of smaller power tools at low cost, such equipment is beginning to find its practical place in rural school shops and on farms. Electric current was added to 51,669 rural homes in North Carolina during the past three years.

A recent survey by forty-five teachers of agriculture in North Carolina revealed that twenty-six per cent of the farms represented by students attending vocational agriculture classes had electric service, and of this number ten per cent of the farms were equipped with one or more of the smaller type power tools.

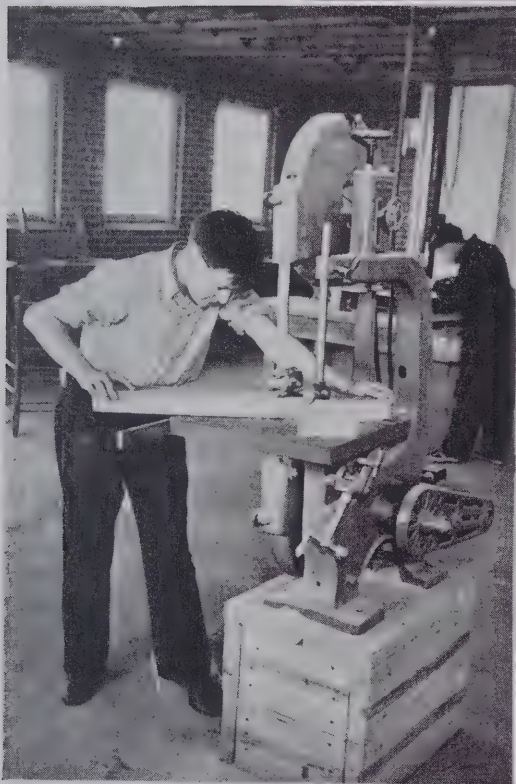
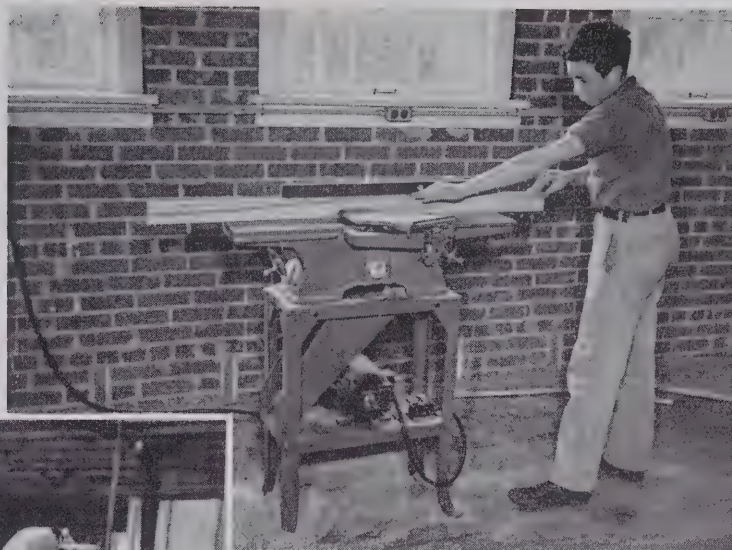
Some power tools are justified in the school shops serving these communities, especially in schools where the shops serve as community work centers for rural youth and adult farmers. Perhaps there is not yet sufficient experience to say just what kind or just to what extent such equipment should be used in school shops.

It is generally agreed by the more experienced teachers that if power tools are to be added, the grinder, drill press, bench saw, jointer, and band saw should be added in the order named. *An adequate supply of hand tools should of course be purchased and used before adding power tools.*

Several factors should be carefully studied before power equipment is added as a part of the school shop equipment: The availability of electricity on farms located in the patronage area of the school, the probable actual use of such equipment on these farms, the available space for proper installation of such equipment at the school, the use of such equipment by part-time and adult classes, and the training and ability of the teacher to use it in a program of shop instruction appropriate for farm boys and farmers.

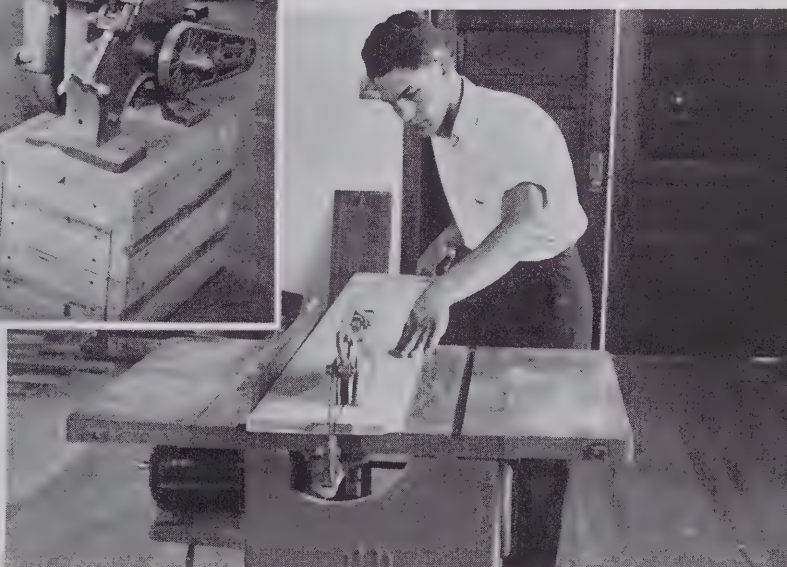
Only quality power tools large enough to render reasonably long service should be purchased for school use. The smaller units of the smaller class of power tools will not hold up. The ten-inch bench saw, and the fourteen or sixteen-inch band saw, for example, are popular, durable sizes for our small rural shops. Motors should be large enough to avoid over-loading.

A
6"-JOINTER



A 16"-BAND SAW

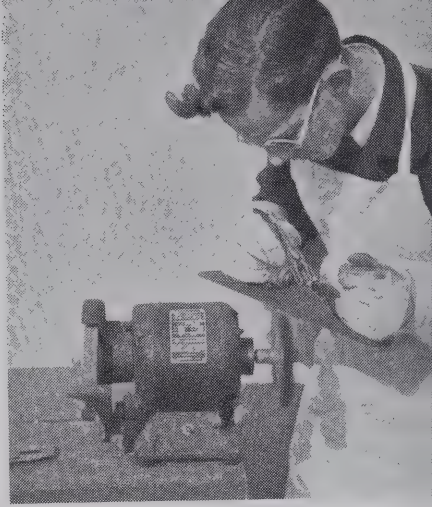
A
10"-BENCH
SAW



In addition to a good grinder and drill press, a bench saw, a jointer and a band saw are practical for rural school shops located in communities where most farms have electric service.

USE SAFETY SHIELDS WHEN CLEANING TOOLS

Tommy Smith, an eleventh grade student of the Coats shop class, is shown at right cleaning and polishing a jack plane with a medium wire brush. The brush is easily placed on one end of a double grinder in place of one of the grinding wheels. Note his heavy work gloves, apron and large eye shields for safety against the numerous pieces of wire bristles broken off and thrown with some force during such operations. No student should be allowed to use the rotary wire brush without these safety shields.



Equipment for Cleaning Tools.—Despite the best of care, rust spots eventually form on shop tools. Knurled surfaces and crevices become rust coated with constant student use. Many shop rooms are located in basements where moisture is in excess. Tools become rust coated quickly under such conditions unless they are given special daily care.

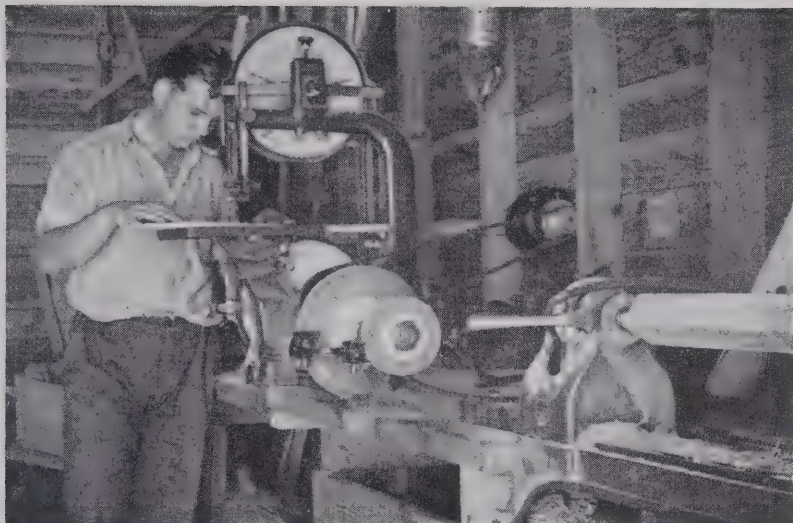
Even with the best of care tools should be cleaned and polished up occasionally. Students should be taught to give every care practical to both school and home shop equipment.

One of the quickest and most practical methods of removing rust and polishing up tools is illustrated on this page. Tommy Smith, Coats High School, Harnett County, demonstrates how to clean a bit, a brace, a screwdriver, a paint brush, a monkey wrench, and a saw. These are only a few of the many that may be quickly cleaned and polished by the rotary wire brush.

Where electric current is not available, scrub the tools briskly with a coarse rag coated with ground pumice and oil. Rub all tools with an oily rag after cleaning and polishing. Keep the tools oil coated at all times when not in use.

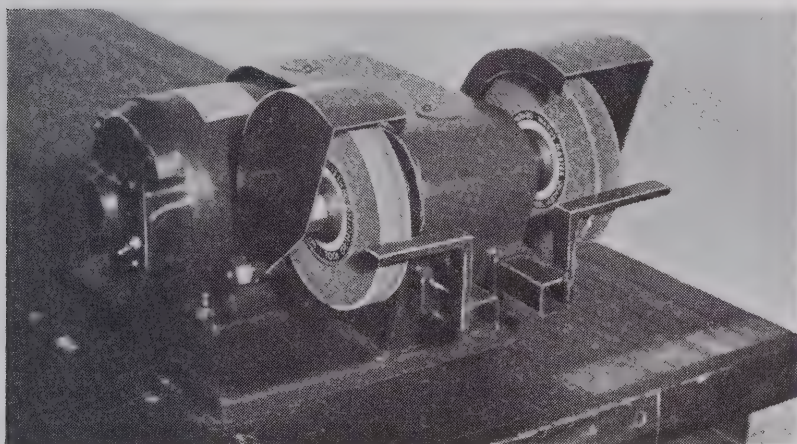
In cleaning an old, dry paint brush, soak for about an hour in varnish remover, wash in turpentine, gasoline, or kerosene, and brush with fine rotary wire brush or hand wire brush, rewash, dry with cloth and wrap in paper so the bristles will not curl.

Practically all painters who use brushes continuously, place them in a metal container filled with water up to the metal band of the brush. The brush should be suspended by some handle support above the container to keep pressure off the bristles. If the brush is not to be used daily, linseed oil should be used in place of water. Water evaporates leaving the bristles dry after a short time. The best care of the paint brush is to clean thoroughly immediately after use and wrap in a piece of tarpaper or other heavy paper and store flat in a box or suspend by the handle.

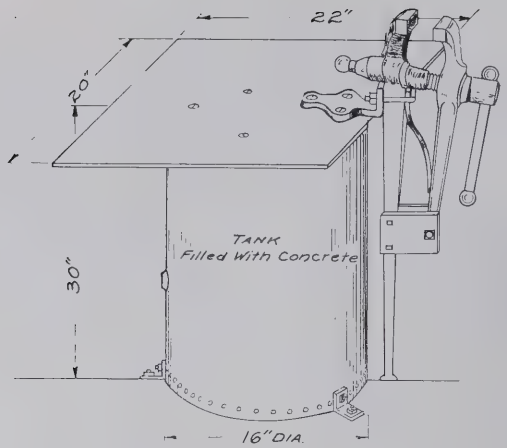
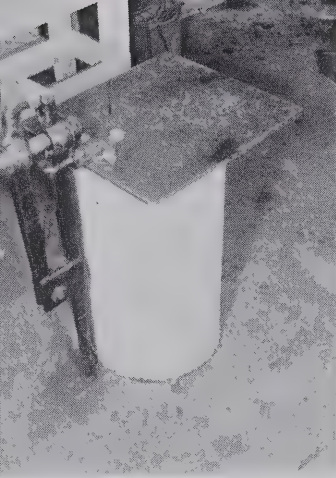


Small Power Tools are Now Used in Home Farm Shops.—Willard Smith, a senior in vocational agriculture is shown above at work in his home shop which he has equipped with a power grinder, band saw and turning lathe.

Willard has done more than two hundred and twenty-five miscellaneous repair and construction jobs at home and at school during his four years in the vocational agriculture course. With this broad experience he is well prepared to do the ordinary construction and repair work on his farm. Power tools have been a means of broadening his experience and now serve as a practical part of the regular farm equipment. *He has a good set of hand tools which he learned to use before purchasing the power tools.*

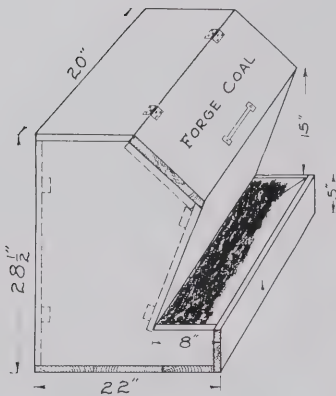


The Roehl General Purpose Grinder.—This is a very sturdy grinder designed especially for farm shops. It is equipped with two 1" x 6" grinding wheels—one fine grit, and the other of medium grit. It is adapted for grinding hand tools, scythes, cutter blades, axes, shovels and other farm tools. It is driven by a split phase, high starting torque, 110 volt, 60 cycle, 1725 R.P.M., one-fourth horsepower motor. The grinding wheel shaft is three-fourths of an inch with sealed ball bearings. The grinder is equipped with safety guards easily adjusted or removed when necessary.



The blacksmith's or metalworking vise should have a heavy anchor and should be mounted so that work can be done from all sides. The picture at the top, left, shows such an installation. The anchor for this vise was built of a section of an old hot-water tank filled with concrete with the top made of a heavy sheet of metal. The metal plate at the top should be three-eighths of an inch to one-half of an inch thick. See the detailed specifications at the right of the picture. The anchor may or may not be fastened to the floor. This anchor was designed and installed at the State College farm shop under the supervision of G. W. Giles, assistant professor of agricultural engineering.

A Handy Coal Bin.—Smoke and dust may be kept to a minimum by proper forge installation. The forge should be installed with a hood and blower in the smoke pipe to remove all smoke from the shop. The picture below shows an inexpensive service forge as set up in the State College farm shop. This type is practical for a farm shop in almost any rural high school. Note the detail specifications for a handy coal bin at the left of the picture. With a properly installed hood and the coal bin as shown, smoke and dust are kept down to a minimum.



A HANDY
COAL BIN

COAL BIN FOR FORGE





It does not take a lot of money to provide metal working equipment for the farm shop. The above pictures show a very practical unit suitable for small rural schools or the farm. This unit was installed by R. L. Fornes, apprentice teacher, at the Woodleaf High School shop, Rowan County. An inverted funnel cap would improve the improvised oil barrel hood to the forge. An old oil barrel poured with concrete is also used to anchor the machinists vise. See opposite page for detailed suggestions on installations.

A MINIMUM LIST OF TOOLS FOR VOCATIONAL AGRICULTURE SHOPS

As recommended by the State Supervisor of Agricultural Education

(Prices and specifications according to General State Contract list No. 1743, North Carolina Division of Purchase and Contract, effective June 1, 1939 to June 1, 1940. Orders must be placed by county superintendent of schools as purchasing agent.)

HAND TOOLS

Woodworking and Miscellaneous Tools

I. Abrasives

No.	Kind	*Unit Price	Total
1	Water grinder, Duro—No. C 3043	\$ 9.31	\$ 9.31
or			
1	Grindstone, mounted ball bearing, R.W. No. 400	7.48	7.48**
or			
1	Grindstone, unmounted 40-50 lb. 18" x 2 1/8" face Cwt.	2.80	2.80**
1	Grinder tool,—Luther—6" thickness 1" —	1.75	1.75
2	Oil stones—Carborundum combination oil stones No. 108	.95	1.90
	Pumice stone, ground Italian 10 lb.	.07	.70
	Sandpaper—1 quire No. 0	.18	.18
	1 quire No. 1/2	.18	.18
	1 quire No. 2	.18	.18
	Emery cloth 1 quire No. 1/2	.82	.82

II. Bits and Braces

1	Set of auger bits—sizes 1/4, 5/16, 3/8, 7/16, 1/2, 9/16, 5/8, 11/16, 3/4, 13/16, 15/16, 1" Irwin Bluwin No. 162T	4.40	4.40
1	Set of gimlet bits, dozen assorted for bit brace	.83	.83
1	Expansive bit—size 7/8 to 3"—Irwin No. 2	.83	.83
2	Screw driver bits—size 1/4 open stock S-26	.13	.26
1	Screw driver bit—size 5/16 open stock S-26	.13	.13
1	Screw driver bit—size 3/8 open stock S-26	.13	.13
1	Screw driver bit—size 1/2 open stock S-26	.13	.13
1	Counter sink—rosehead—Stanley No. 129, 3/4"	.25	.25
1	Ratchet brace 10" swing—Stanley No. 919	3.46	3.46
3	Non-ratchet braces 10" swing—Stanley No. 916	1.72	5.16
1	Soil auger,—1—No. 4A	3.50	3.50

*Payable within 30 days.

**Unmounted and mounted grindstones not included in total cost.

III. Chisels

No.	Kind	*Unit Price	Total
1	Set $\frac{1}{4}$ " to $1\frac{1}{2}$ " in quarters Stanley No. 501 -----	6.73	6.73

IV. Clamps

2	Bar clamps 5'—Hargrave No. 640 -----	\$ 2.05	\$ 4.10
2	Hand Screws 10"—Hargrave -----	1.00	2.00
2	C clamps 4"—Hargrave No. 540 -----	.29	.58
2	C clamps 5"—Hargrave -----	.46	.92
2	C clamps 7"—Hargrave -----	.67	1.34
2	Clamps 10"—Hargrave -----	1.05	2.10

V. Drills

1	Breast drill No. 455 Yankee—double speed	5.20	5.20
1	Hand drill $\frac{3}{8}$ " chuck—Stanley No. 626---	2.42	2.42

VI. Files

2	File 10" mill files, bastard,—Nicholson or Disston -----	.30	.60
2	Half round cabinet files 8"—Nicholson or Disston -----	.29	.58
2	Flat cabinet files 10"—Nicholson or Disston -----	.30	.60
6	Extra slim taper saw files $5\frac{1}{2}$ "—Nichol- son or Disston -----	.22	1.32
6	Auger bit files—Nicholson or Disston ----	.18	1.28
1	Disston file cardbrush 5" x $1\frac{1}{2}$ ", D-No. 2--	.55	.55

VII. Hammers

6	Adze eye ball face 16 oz. hammer No. 51 $\frac{1}{2}$ Stanley -----	.72	4.32
2	Ripping, nail hammer No. 51 $\frac{1}{2}$ A -----	1.10	2.20

VIII. Hatchet

2	Half hatchets $3\frac{1}{8}$ "—Stanley No. 21 -----	.81	1.62
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IX. Measuring Devices

6	Try squares 8" blade—Stanley No. 12 ---	.60	3.60
1	Combination square—Stanley No. 21— 12" -----	.69	.69
1	Sliding T bevel—Stanley No. 18—8" ----	.72	.72
4	Framing squares—Stanley No. R-100 ----	1.45	5.80
1	Steel tape 50'—Lufkin Universal No. 543 -	2.18	2.18
1	Dividers 8" wing—Pexto -----	.72	.72

X. Planes and Plane Bits

6	14" Jack plane—Stanley No. 5 -----	2.64	15.84
1	Block plane—Stanley No. 118 -----	1.57	1.57
6	Plane bits for No. 5 jack plane -----	.40	2.40
3	Spoke shaves, malleable No. 151 Stanley --	.63	1.89
1	Plane bit for No. 118 block plane -----	.26	.26

XI. Saws

No.	Kind	*Unit Price	Total
1	26" Rip saw, 7 pts. D-No. 8H26 -----	\$ 2.12	\$ 2.12
3	26" Crosscut saws 10 pts. D-No. 8H26 -----	2.12	6.36
3	26" Crosscut saws 8 pts. D-No. 8H26 -----	2.12	6.36
2	Hack saws—S-No. 33 -----	.67	1.34
12	Hack saw blades 10", dozen MF -----	.46	.46
3	Coping saws—D-No. 10 -----	.48	1.44
2 doz.	Extra blades for coping saw—D-No. 10 -----	.13	.26
1	Pistol grip saw set—Stanley No. 42 -----	1.20	1.20

XII. Screw Drivers

1	3" Screw driver—Stanley No. 20 -----	.22	.22
2	5" Screw drivers—Stanley No. 20 -----	.25	.50
2	8" Screw drivers—Stanley No. 20 -----	.37	.74
1	10" Screw driver—Stanley No. 20 -----	.45	.45

XIII. Vises

4	Woodworking bench vises No. 5 CDS Columbia 4" x 7" -----	5.70	22.80
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XIV. Miscellaneous

1	Wrecking bar, $\frac{3}{4}$ " x 30"—Stanley No. 130 -----	.41	.41
2	Putty knives, stiff blade, $1\frac{3}{8}$ " x $3\frac{3}{4}$ " Pexto or Remington -----	.14	.28
1	Level—Stanley No. 2, 26" -----	1.54	1.54
1	Nail sets, square head $\frac{3}{4}$ A. 1 Doz. Asst. Stanley No. 1134 -----	.93	.93
2	Oilers (oil cans) Wheeling -----	.18	.36
1	8" pliers, P. E.—No. 40 -----	1.05	1.05
3	Slip joint pliers 6" Kraueter -----	.20	.60
1	Set steel stamp letters and figures $\frac{1}{4}$ " machine made, figures (hard metal)-----	1.15	1.15
	letters (hard metal)-----	3.20	3.20
2	Draw knives, 8" Pexto -----	1.15	2.30
2	Soldering coppers complete with handles No. 2 pair -----	.30	.30
1	Pound solder Kester acid core -----	.60	.60
1	Tinners snips—Pexto or Crescent No. 13 —8" -----	.65	.65
1	Snips, Crescent circular cutting 3", No. T412 -----	1.03	1.03
1	Blow torch, Clayton & Lambert, No. 600--	2.91	2.91
1	Trowel—Rose—No. 110, 10" -----	1.48	1.48
1	Farm level—Bostroms No. 2B -----	19.98	19.98
1	Set bit stock drills for metal or wood $\frac{1}{8}$ " to $\frac{3}{8}$ ", Blue Grass No. BG411-----	2.00	2.00
6	Paint brushes No. 550 Osborn 1" -----	.15	.90
6	Paint brushes No. 550 Osborn 2" -----	.25	1.50
6	Paint brushes No. 444 Osborn 2" -----	.30	1.80
6	Paint brushes No. 434 Osborn 3" -----	1.10	6.60

Total, hand woodworking tools ----- \$204.05

COLD METALWORKING TOOLS AND EQUIPMENT

(Current specifications by State Division of Purchase and Contract.
Approximate cost of total list, \$35.)

No.	<i>Kind</i>
1	Anvil, steel faced 70 lb.
1	Chisel, 1 1/4"—Stanley No. 1290 handled cold cutter
1	Chisel, hand chipping 5/8"—Stanley No. 99
1	Chisel, hand chipping 3/4"—Stanley No. 99
1	Chain drill, No. 1500 Yankee 3 jaw
1	Hammer, blacksmith's hand, 32-oz. drop forge steel, Stanley 401
1	Hammer, machinist drop forge steel, 16-oz. Stanley 309B
1	Vise, machinist stationary base 4"—jaw—American Scale Co. Red Seal No. 53
1	12" monkey wrench, knife handle—Trimo
1	Center punch 1/2"—S-No. 638
2 or 3	Sizes of square and punches listed as "solid punches" where drill press not available
1	Hack saw
1	Pliers (that will cut wire desirable)
1	Snips

Where plumbing tools are not available two pipe wrenches or one pipe vise and one pipe wrench will be often used in repair work.

HOT METALWORKING TOOLS AND EQUIPMENT—OPTIONAL

(Current specifications by State Division of Purchase and Contract.
Approximate cost of total list, \$40.)

No.	<i>Kind</i>
1	Anvil, steel faced 70 lb.
1	Hardie No. 1—Stanley 1", No. 1310
1	Chisel, 1 1/4"—Stanley No. 1290 handled cold cutter
1	Chisel 1 1/4"—Stanley No. 1300 handled hot cutter
1	Chisel, hand chipping 5/8"—Stanley No. 99
1	Chisel, hand chipping 3/4"—Stanley No. 99
1	Chain drill, No. 1500 Yankee 3 jaw
1	Forge, Champion No. 146S (with hood)
1	Hammer, blacksmith's hand, 32-oz. drop forge steel, Stanley 401
1	Hammer, machinist, drop forge steel, 12-oz. Stanley 309B
1	Tongs No. 10—20" Stanley—straight lip
1	Tongs No. 12—20" Stanley—curved lip
1	Vise, machinist stationary base 4"—jaw—American Scale Co. Red seal No. 53
1	12" monkey wrench, knife handle—Trimo
2	Punch 1/4" point, 10" length, octagon tool steel, H-No. 2856
2	Punch 1/8" H No. 263
2	Punch 3/16" H No. 263
1	Center punch 1/2"—S-No. 638
1	Drift punch 1/4", 10"—No. 630
1	Hack saw
2 or 3	Sizes of end wrenches, desirable
2	12" or 14" pipe wrenches should be included to use for repair work if plumbing tools are not purchased.

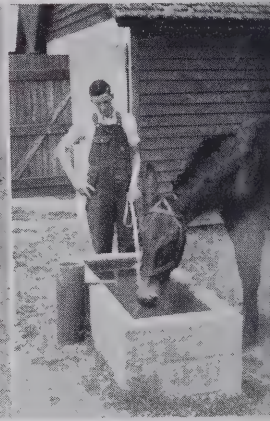
POWER TOOLS

A complete line of woodworking machinery for small rural shops is available to the public schools at state contract prices. Write the North Carolina Division of Purchase and Contract, Raleigh, North Carolina, for information and prices.

TOOLS FOR PIPE FITTING AND GENERAL SERVICE PLUMBING ON FARMS

(Current specifications by the State Division of Purchase and Contract.
Approximate cost of total list, \$25.00.)

No.	Kind
1	Pipe stock and dies—Armstrong No. 2½ A, ratchet type
1	Pipe vise No. 2 American Scale Co., ⅛"—2"
2	Pipe wrenches, Trimo 14"
1	Fluted tapered pipe reamer for use in brace, size ¼" to 1¼"
1	Pipe cutter (that will cut up to 1¼" pipe—roller type preferred)
1	Hack saw
1	20" or 24" pipe wrench often needed
1	Oil can (oiler)
1	12" flat file
1	½" cold chisel
End wrenches, pliers, and screw driver will be useful on the job.	



Many homes have been provided with running water by the supervised home work of students of vocational agriculture. Certainly every school shop should be provided with the above list of simple pipe fitting tools. Pictures above, reading left to right, show Paul Partin, Leggetts High School, Edgecombe County, learning the simple job of cutting pipe. Charles A. Breedlove, Middleburg, observes a sanitary spring, housed in concrete, that furnishes his home with running water. He with other vocational agriculture students installed the water system. The electric pump is housed nearby in a rock house from which pipe lines lead to his home nearby. Marshall Floyd, another Middleburg student, leads old Jerry to a fresh drink of water supplied by a farm water system installed by him under the supervision of his teacher, George B. Blum. Other students of the community have installed similar water systems in their homes.



Eugene Jobe, Alamance High School student, does his home shop practice in farm pipe fitting by laying a water line for the home water supply. A. B. Hunter, his teacher of agriculture, is seen holding the pipe. Members of Mr. Hunter's class worked with Eugene in mapping out the lines and calculating the materials. Eugene did most of the ditch digging, fitting and laying the pipe.

A FEW SELECTED REFERENCES FOR FARM SHOP TEACHERS AND STUDENTS

ROEHL, L. M., *Farmer's Shop Book*, The Bruce Publishing Company, Milwaukee, Wisconsin, 1939. Latest edition. Retail price, \$2.80. 422 pages.

This book is on the State's adopted list. The latest edition is completely revised and enlarged and is highly illustrated. Every teacher of agriculture should have several copies of this book for his farm shop classes.

JONES, MACK M., *Farm Shop Practice*, McGraw-Hill Book Company, New York City, 1939. Retail price, \$2.75. 315 pages with 360 illustrations.

This new text deals simply yet thoroughly with tools and basic tool processes used in the farm shop. It is designed to supplement discussion and demonstration and for study and review. Every farm shop teacher should have one or more copies.

DOUGLASS AND ROBERTS, *Instruction and Information Units for Hand Wood-working*, The McCormick-Mathers Company, Wichita, Kansas, 1932. Retail price, \$0.80. 104 pages.

This booklet is organized with "companion" units—information about the tool or methods to be used and how to do the job. For example, in the set-up on the wood chisel the first unit gives information about the types of wood chisels and the second unit, or companion unit, gives directions and methods on how to use a wood chisel. This is a good reference for the beginner.

FRYKLUND AND LABERGE, *General Shop Woodworking*, McKnight and McKnight Company, Bloomington, Illinois, 1936. Retail price, cardboard cover, \$0.72; cloth bound, \$0.96. 128 pages.

This work book was written primarily for use in junior high schools. It is organized with seventy-one units classified under the general headings: (1) What you should be able to do and (2) What you should know. "To lay out and cut stock," "To sharpen and use a hand scraper," are examples of units under the first heading. "To read a working drawing," "seasoning of lumber," are examples of units under the second heading. This is a good reference for the beginner.

COOK, SCRANTON, AND MCCOLLEY, *Farm Mechanics Text and Handbook*, Interstate Printing and Publishing Company, Danville, Illinois, 1935. Retail price, \$2.50. 450 pages.

Emphasis is given in this text on the selection and purchasing of suitable equipment and supplies used in woodworking, painting, finishing, glazing, concrete work, sheet metal work, farm forge work, etc. "Classifying, selecting, and caring for lumber," and "The classifying, care and use of woodworking tools," are headings of two chapters indicative of the nature of the content.

DINKINSON, *Job Operations in Farm Mechanics*, The Interstate Printing and Publishing Company, Danville, Illinois, 1936. Retail price, \$1.25. 165 pages.

This guide for farm shop work was originally prepared by teachers of agriculture of Missouri. It is organized on the job basis. The materials, tools, and procedure are listed with questions and references for study under each job. It is a good reference for use of students.

JONES, MACK M., *Manual of Farm Shop Work*, The University Cooperative Store, Columbia, Missouri, 1935. Retail price, \$0.25. 81 pages.

This manual consists of plans for small devices and appliances that may be made at home or in the school shop. The devices were included on the basis of the tool processes involved, the usefulness of the devices and the small amount of materials necessary to do the job. It includes eighteen devices which may be made from wood, ten from cold metal and fifteen from hot metal.

COGGIN, ARMSTRONG AND GILES, *A Manual on Sharpening Hand Woodworking Tools*, Interstate Printing and Publishing Company, Danville, Illinois, 1939. Retail price, \$0.29. 50 pages.

A highly illustrated handbook for the individual student's use with a total of 176 close-up drawings on how to sharpen 13 different hand working tools, including hand-saws, timber saws, chisels, plane bits, etc. All drawings are associated with text directions, giving full information on just how to do the job. It is especially adapted for the beginner.

SMITH, J. WARREN, "Safety Education for Shop Teachers in North Carolina Schools," Bulletin 2, Industrial Education Series, Division of Teacher Training, North Carolina State College, Raleigh, North Carolina.

This bulletin is free to teachers of agriculture in the State. It contains, among other things, specific safety rules for operating power tools, and for the use of hand tools. Shop teachers and their students should give it special study.

REFERENCES ON POWER TOOLS

GRIFFITH & COX, *Woodwork for Secondary Schools*, The Manual Arts Press, Peoria, Illinois. Retail price, \$2.00. Pages 76 to 152 of this book are devoted to the operation and use of woodworking machinery. It is a good reference for students and teachers whose shops are equipped with power tools.

Manufacturers of the smaller power tools publish a number of very practical references. Following is a partial list:

The Walker-Turner Co., Inc., Plainfield, N. J.

The Drill Press	\$0.50
The Bench Saw, Jointer and Shaper50
The Lathe50
The Band Saw and Jig Saw50

The Delta Manufacturing Co, Milwaukee, Wis., publishes a similar list. Write the manufacturers of the machines you use for information about booklets and other references published by them.

MAGAZINES

There is no one publication, monthly or otherwise, especially adapted for the use of teachers of farm shop work. The few listed below are very popular. Almost every issue has a number of practical suggestions for the teacher of agriculture and his students:

The Delta, Delta Mfg. Co., 600-634 E. Vienna Ave., Milwaukee, Wisconsin.
Six copies a year. \$0.50.

Popular Science, Popular Science Publishing Company, 353 Fourth Ave., New York City. Twelve copies a year. \$1.50.

Agricultural Education, Meredith Publishing Co., Des Moines, Iowa. One year, \$1.00.

Industrial Arts and Vocational Education, Bruce Publishing Co., 540 North Milwaukee Street, Milwaukee, Wisconsin. Ten copies a year, \$2.50.

Better Homes and Gardens, Meredith Publishing Co., Des Moines, Iowa, one year, \$1.00. (Suggestions on lawn equipment and arrangement.)

SOME SUGGESTED CRITERIA FOR EVALUATING FARM SHOP ACTIVITIES AND EQUIPMENT

Suggested List for Shop Teacher To Check:

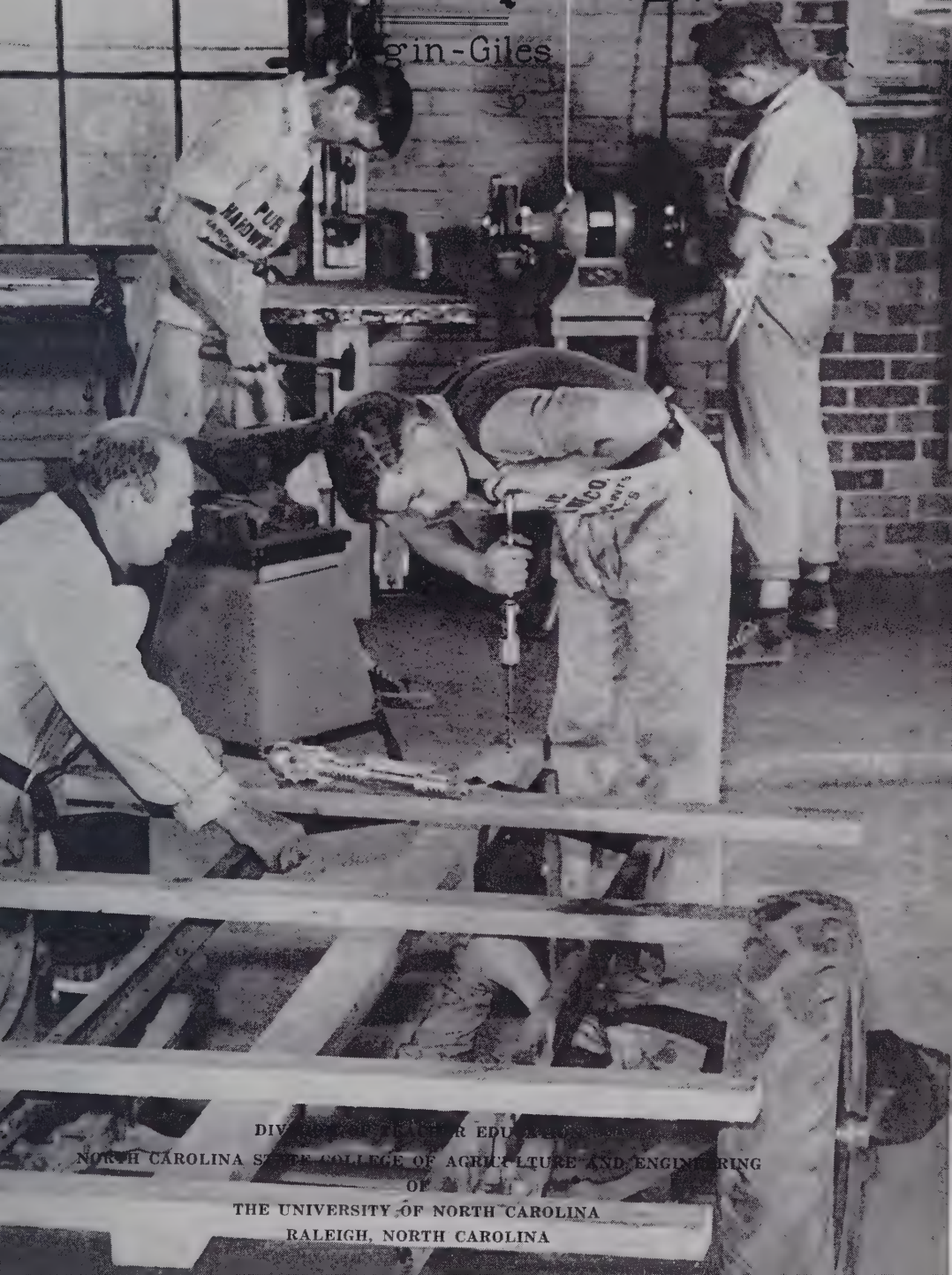
- (.....) Are the shop jobs undertaken by the students drawn from the actual repair and construction jobs necessary for maintaining and improving the farm home, the farm landscape, the farm buildings and the simpler farm equipment on the farms represented?
- (.....) Are the individual shop activities based upon and projected from the student's actual problems as a farm worker or homemaker?
- (.....) Are the shop activities at the school and the shop activities at home definitely related—*e.g.*, Are the practices engaged in actually bettering the student's home and farm conditions?
- (.....) Does the student understand the problems to be decided on and to be done?
- (.....) Does the shop teacher use the experiences of the student as a starting point in the teaching-learning process?
- (.....) Does the shop teacher take into account both the interests and needs of the individual before approving the student's shop activities?
- (.....) What contribution does the shop program make towards the individual's education from the standpoint of vocational and educational guidance and other educational values?

- (.....) Are the materials used in the construction and repair jobs appropriate for the use they are employed?
- (.....) Does the student share the responsibility in planning and furnishing the materials used?
- (.....) Are the materials on hand and in the shop properly classified and racked?
- (.....) Are the standards of workmanship commensurate with the individual's capacity and maturity?
- (.....) Are individual students encouraged to rely upon their own resources—to maintain and improve what they have?
- (.....) Is the shop equipment arranged and adjusted so that students of different stature can do their shop skills properly?
- (.....) Is the shop equipment available to and used by out-of-school young farmers and adults?
- (.....) Are the tools arranged and racked for most efficient work?
- (.....) Are the tools kept in good condition and repair?
- (.....) Are the tools, shop space, supplies and references adequate?
- (.....) Does the shop teacher have a systematic way of determining from his files the type, scope and quality of work done by each student?
- (.....) Considering the shop teacher's records as a whole, could a new teacher begin an intelligent program of instruction to follow through or modify the work carried on by the old teacher?

FARM SHOP

ACTIVITIES AND EQUIPMENT

W. G. Ginn-Giles



DIVISION OF AGRICULTURE AND MECHANICAL EDUCATION

NORTH CAROLINA STATE COLLEGE OF AGRICULTURE AND ENGINEERING
OF AGRICULTURE

THE UNIVERSITY OF NORTH CAROLINA

RALEIGH, NORTH CAROLINA

* * * * "Fortunately schools, by means of guidance and instruction, are taking a far more active part than they ever did before in helping young people to get started in their occupational careers" * * * * "There are valid educational reasons for advocating a work program as an essential part of the curriculum of secondary schools. A pupil gains, through the constructive handling of tools and materials, insight into the nature of things and insights with regard to his relations to his environment that he cannot gain in any other way. Modern psychology recognizes as one of its most fundamental principles the truth that reactions, or what are commonly called 'behavior patterns,' condition the development of experience far more than do impressions. It is only when an individual reacts to an object that he concentrates attention on it and becomes fully aware of its character and value."—"What the High Schools Ought to Teach," The Report of a Special Committee, American Council on Education, Washington, D. C., 1940. pp. 19-20.

"The nation that has ignored work as an educative factor has failed to function fully, or has perished. Democracy has neither developed nor survived without this recognition. In our educational scheme we have almost lost sight of this fact. At this particular juncture in our national existence let us ask ourselves whether in our eagerness not to deprive the youth of their birthright of education, we have not robbed them of that other birthright—the right to know how to earn a living. We believe that as a nation we have come precariously near this in our educational scheme. We believe in work and proper preparation of our youth to perform work. People must know how to work if they are to know how to live."—Dr. Robert O. Small, Boston, ex-president of the American Vocational Association. *Michigan Vocational Outlook*, Volume 4, Number 1, September, 1941. p. 23.

AGRICULTURAL TEACHERS' SERIES

BULLETIN 5

JUNE, 1942

FARM SHOP ACTIVITIES AND EQUIPMENT

By

J. K. COGGIN AND G. W. GILES

DIVISION OF TEACHER EDUCATION
NORTH CAROLINA STATE COLLEGE OF AGRICULTURE AND ENGINEERING
OF
THE UNIVERSITY OF NORTH CAROLINA
RALEIGH, NORTH CAROLINA

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Certain materials and illustrations were taken from a previous department publication, Bulletin 4, *Farm Shop Activities and Equipment for Students of Vocational Agriculture*, now discontinued.

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By

J. K. Coggin and G. W. Giles

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FOREWORD

This bulletin is designed for the use of teachers of vocational agriculture. It is prepared to emphasize the importance of farm shop work in a well-balanced program of vocational education in agriculture, and to aid teachers of agriculture in setting up and arranging adequate equipment for a broader shop program in the rural high schools of the State. The importance of the farm shop program, the types of farm shop activities now being conducted in the rural schools of the State, and suggestions for arranging the shop equipment are portrayed by the use of a large variety of illustrations.

Teachers of vocational agriculture in North Carolina are urged to place greater emphasis upon the teaching of farm shop work. State College is stressing the teaching of farm shop to a greater degree than ever before in its teacher education program. Ample provision for an up-to-date farm shop with modern equipment has been made in the new quarters of the Teacher Education Division.

In adapting the rural high school curriculum to the needs of rural people, emphasis upon farm shop work takes on new significance. Such activities will have a far-reaching influence upon the improvement of rural homes through the teaching of farm shop to the boys and men attending the day school, the part-time classes and the evening adult classes conducted by the teachers of vocational agriculture. As has been so well brought out in this bulletin, most of the repair jobs and simple construction jobs on the average North Carolina farm must be done, if done at all, by the boy or the man on the farm.

The farm shop program, by giving to the individual an outlet for his creative impulse takes on an educational value far beyond that usually accepted. There are great educational as well as practical values in shop activities—not only in the thing made but also in the realization of the ability to create and to do a good job with one's own hands. A worthwhile job accomplished is a source of satisfaction and joy to almost every individual and thus a source of motivation for future learning.

This bulletin was prepared by J. K. Coggin, Professor of Agricultural Education in the Division of Teacher Education, and G. W. Giles, Associate Professor of Agricultural Engineering in the Department of Agricultural Engineering, both of whom have worked for a number of years with teachers of agriculture in the field of farm shop work. I commend it most heartily to the teachers of vocational agriculture in North Carolina.

T. E. BROWNE, Director
Division of Teacher Education
N. C. State College.

June, 1942.

SOME VALUES OF FARM SHOP WORK ¹

A Survey of Current Research and Opinions.—The author made a survey of the Land-Grant colleges of the country to determine what studies had been made of the value of farm shop work towards the economical operation of the farm. Letters were sent to heads of the departments of agricultural economics of the southern states and to the directors of the experiment stations of the majority of the other states. Many interesting replies were received. Only a few states have done any research directly on this problem. However, a number of valid opinions on the problem were expressed by those replying. Excerpts of some of the studies and of some of the letters giving valid opinions are included here:

"In checking over some results of studies made here in Louisiana, it appears that the farmer who is well prepared to do his own farm shop work would save annually from \$20 to \$25 on small farms and as much as \$80 on large farms. These represent rather large savings in terms of the total net income which farmers in the upland cotton area usually receive. In the rice area, having a good farm shop—and this would mean a rather expensive outlay for shop equipment—a farmer might save annually from \$150 to \$160.

"I believe these represent fairly typical conditions for upland cotton farmers and for rice farmers in this area."—R. J. SAVILLE, *Head, Department of Agricultural Economics, Louisiana State University, University, Louisiana.*

George B. Byers and B. T. Inman, authors of the Kentucky Experiment Station bulletin 345, "The Use and Expense of Farm Implements," found that repair shops made possible a saving of \$5.47 in expense for each \$100 of implement investment. Following is a quotation from page 246 of this bulletin:

"The repair shop made possible a saving of \$5.47 in expense for each \$100 of implement investment. . . . This saving was due to the avoidance of much high-priced mechanical labor and the use of farm labor during slack periods of the year. This farm labor amounted to about forty-six hours per farm with shops and fifteen hours per farm without shops, or a difference of thirty-one hours. Having the facilities to repair implements during odd times through the year tends to keep the implements in better condition, prevents the loss of time during busy seasons, and enables the farmer to make more economical use of his farm implements."

Values of the repair shop towards the repair and upkeep of buildings and other general farm equipment was not included in the above study.

In their baccalaureate thesis, "A Study of the Home Farm Shop in Relation to Needs in Specific Areas in Indiana," Leonard Kingsley and Clarence Creager, seniors in the class of 1939, found:

- "1. Indications are that the majority of the farms studied lack suitable shop buildings in which to do their shop work.
2. According to the studies of these farms, the tools and equipment available on the farms are inadequate.

¹ Coggin, J. K., *Farm Shop Activities and Equipment for Students of Vocational Agriculture*. Bulletin 4, 1940. pp. 9-13. (Out of print.)

3. There seemed to be a direct influence of vocational agriculture training in the high school upon the type and quality of shops found on the farms.
4. This study seems to indicate the increased use of electrical and mechanical power on the farms of these particular areas."

Recommendations:

- "1. It would seem that emphasis in teaching should be placed on the proper use and care of the simple, most used pieces of shop equipment rather than the more complicated equipment that is seldom found in shops on farms.
2. The storage and proper care of equipment not in use might well be emphasized in the teaching procedures. This fact alone is undoubtedly one of the most outstanding defects of the average farm shop.
3. In setting up a course of study for the teaching of farm shop in the high school, consideration should be given to the average size of the farm and the type of farming in the community in which farm shop is to be taught, as these factors have a direct influence upon the types of farm shop jobs that are to be emphasized."

I. G. Morrison, Assistant Professor of Agricultural Education and Farm Shop Teacher Trainer, Purdue University, Lafayette, Indiana, reported the above study with this comment:

"While these conclusions do not specifically answer your questions, discussions of the problem with the boys indicated that where farm shops of any quality existed, the farmstead, the farm, and other indications pointed to the fact that the farmer was superior to his neighbor having no shop available."

"In general, our better and more successful farmers have some sort of a building or a place in a building to do the necessary farm mechanical repair and overhauling work, and for the purpose of storing miscellaneous equipment, tools and supplies. In the West much expensive equipment is used in farming and good farm management implies that this equipment is kept in good running order. Much of the repair and overhauling work must be done in slack seasons and often during periods of inclement weather which necessitates a dry and often, too, a warm place to work. These necessitate a farm shop on the farm.

"We regard the various phases of farm mechanical work arising on farms as an integral part of farming, and therefore strictly vocational. If education implies helping one to better engage in life's activities and better cope with life's problems, then effective training in all essential phases of farm mechanics is good education for one expecting to engage in real dirt farming.—G. A. SCHMIDT, *Professor of Vocational Agriculture, Colorado State College, Fort Collins, Colorado.*

"My observations lead me to the conclusion that the ability of a farmer to divide all of the farm tasks into two general classes, those which are urgent and those which are not urgent, is one of the most essential requirements of a good farm manager. Furthermore, the skill possessed by the farmer and his family in farm work shop jobs is directly correlated with income.

"However, this skill is not only needed for non-urgent tasks such as repairing fences, but also for urgent tasks such as repairing a mower. My studies indicate that, due to the seasonal nature of farm practices, many farmers confine their work to the urgent tasks and are unemployed on their own farms for a considerable portion of the year because they do not plan and lack the skill in materializing non-urgent practices."—J. WILLIAM FIROR, *Head, Department of Agricultural Economics and Rural Sociology, University of Georgia, Athens, Georgia.*

"Observation teaches us in Kansas that the farmer who maintains a farm shop and uses it is usually a more successful farmer than the one who doesn't. No farmer ever went broke because he could not do many of the small jobs continually arising on the average farm, but we do know of many Kansas farmers who have gone broke because they were continually on the road between home and town to get some small repair job done which should have been done at home.

"A good farm shop will encourage many farm boys to stay on the farm as it gives them an outlet for the urge every boy has to work with tools. A good foundation in the use of tools which many a farm boy has obtained by having a good shop on the farm has enabled many of them to adapt themselves to changing conditions which they have been confronted with after leaving the farm."—M. R. WILSON, *Associate Professor, Farm Shop Practice, Kansas State College, Manhattan, Kansas.*

"There are large numbers of minor mechanical operations in the way of repairs and replacements that can be economically performed with a modest farm work shop. A good many of our farm tools are now built on principles followed in the building of an automobile and it would scarcely be worth while for a farmer to attempt to keep a shop adequately equipped to deal with such machinery. However, there is such a wide discrepancy between farm wages per hour and city mechanics' wages per hour that the farmer can scarcely afford to have city mechanics do many of the simpler repair jobs. A modest repair shop for the simpler jobs would, therefore, seem to be distinctly desirable; while a repair shop with sufficient equipment and skill in operation to make repairs on tractors, combines, and the like would still not seem to be advisable.

"There may be one exception in this last case; namely, for a man who is mechanically inclined, a repair shop where he can do repair work for his neighbors may justify itself. I happen to know of two instances of this sort. In both cases, the investment in the repair shop will run up to more than \$1,000. Such a shop would be out of the question except for the fact that in both of these cases the farmer-mechanic owning the shop and operating a farm is really doing two jobs, part-time farming and running a machine shop."—O. R. JOHNSON, *Professor of Agricultural Economics, University of Missouri, Columbia, Missouri.*

". . . in general, small farms do less along shop lines than do middle-sized or large farms—small farms being under 100 acres, middle-sized or large farms 100 to 249 acres, and large farms 250 acres and over. Tenants do as much farm shop work as owners, but it is generally of a temporary nature, such as horse-shoeing, etc. The owner does more in the line of machinery, concrete, etc. . . .

". . . I would say that more efficient farm shop work is one of the reasons which tend to make a farm a better one. It seems that a farmer can operate his farm more economically if he is trained, has the equipment, and

does his own shop work. Studies in farm management show that during the year a great deal of time is wasted on the farm. This time could well be used in shop activities.

"The social implications behind the farmer's shop are tremendous. I believe that shop work is one factor influencing rural living to a great extent. It is one way of keeping boys interested so that they will stay on the farm, and it is a way of retaining their interest after they do stay there. The motivation is there, as most youngsters like to tinker and this answers that problem very nicely. . . . From a school point of view, it is quite evident that farmers get a great deal out of their work in machinery repair, etc. If we go on the assumption that we learn to do by doing, farmers certainly get a lot in the line of education from the mechanical work which they do."—CARLTON E. WRIGHT, *In charge, Applied Farming Course, University of New Hampshire, Durham, New Hampshire.*

"... I have operated a farm of my own for several years and know the value of a shop from personal experience. I find that it saves considerable time in going back and forth to a shop elsewhere, and that labor is also less. I have a man employed on the farm who is handy with tools and he can do much of the work of this kind when other jobs are not pressing. It also helps him by enabling me to provide him with more regular employment. I also permit him to use the shop to do jobs for the neighbors, when our own work is not pressing, for which he receives the entire amount paid."—CHARLES E. ALLRED, *Head, Department of Agricultural Economics and Rural Sociology, University of Tennessee, Knoxville, Tennessee.*

"I believe that practically every farmer above the status of half share-cropper has a few shop tools with which to work and a place where he usually uses them. This may be at a block of wood in the shade of a tree, on a back porch, in the shed of a barn, or even an especially constructed shop.

"Values from shop use might be: (1) saving cash outlay; (2) saving through elimination of the necessity of travelling some distance to the shop in a busy season; (3) saving "waste" time in rainy or bad weather when most shop work should be done; (4) permitting the doing of a job when it should be done; (5) making or adjusting tools and equipment to fill more adequately the farm needs and (6) providing certain tools that cannot be bought which, nevertheless, may be needed on a particular farm. In addition, some farmers may earn cash by servicing neighbor's tools or doing other odd jobs with the shop equipment."—BEN F. ALVORD, *Head, Department of Agricultural Economics, Alabama Polytechnic Institute, Auburn, Alabama.*

SUMMARY

1. Studies in Louisiana show that farmers who are prepared to do their own farm shop work save annually from \$20 to \$24 on small farms in the upland cotton area and about \$80 on the larger farms.
2. George B. Byers and B. T. Inman, authors of the Kentucky Experiment Station Bulletin 345, "The Use and Expense of Farm Implements," found that repair shops made savings of \$5.47 in expense for each \$100 of implement investment.

3. In their baccalaureate theses "A Study of the Home Farm Shop in Relation to Needs in Specific Areas in Indiana," Leonard Kingsley and Clarence Creager found:
 - a. That a majority of the farms in Indiana lack suitable tools and equipment and shop buildings to do adequate farm shop work (1) that vocational agriculture training had a direct influence upon the type and quality of shops found on these farms and (2) that electrical and mechanical power were on the increase on Indiana farms.
4. Observations and findings by other agricultural leaders on the value of farm shop work towards the successful operation of the farm are:
 - a. That the more successful farmers have some sort of place or building in which to do farm repair and construction work.
 - b. That the skill possessed by the farmer and his family in farm shop jobs is directly correlated with income on the farm.
 - c. That "a good farm shop will encourage many farm boys to stay on the farm as it gives them an outlet for the urge every boy has to work with tools."
 - d. A good foundation in the use of tools which many farm boys have obtained in farm shops has enabled them to adapt themselves to changing conditions which confront them after leaving the farm.
 - e. Minor mechanical operations in the way of repairs, construction and replacements can be economically performed with a modest farm work shop.
 - f. Farm shop work is an important factor towards the improvement of rural living standards.
 - g. A farmer who has the ability and actually does his simpler farm shop work saves (1) in cash outlay; (2) saves "waste" time in rainy or bad weather when most shop work is done; (3) saves by doing an emergency shop job in the rush season; (4) saves by adjusting and adapting tools and equipment to fit the farm needs better; (5) saves by providing certain tools and appliances which cannot be bought but which may be needed to do a particular job; and (6) saves time in doing the job at home that otherwise would require travel and expense to have it done away from the farm.

Research on the Values of Farm Shop Work Should be Extended.—It is evident from the survey made that only a limited amount of research has been undertaken to determine the values of a farm shop program, economic or otherwise. However, this brief summary of the values of farm shop work, as evidenced by the limited research already done and by the opinions of certain agricultural economists and others, indicates that teachers of vocational agriculture are justified in devoting their time and effort towards a more effective program. Further studies should be made to determine more fully the values of such a program, especially in the light of the present rapid trend of increasing shop work in the rural schools as a part of the vocational agriculture program.



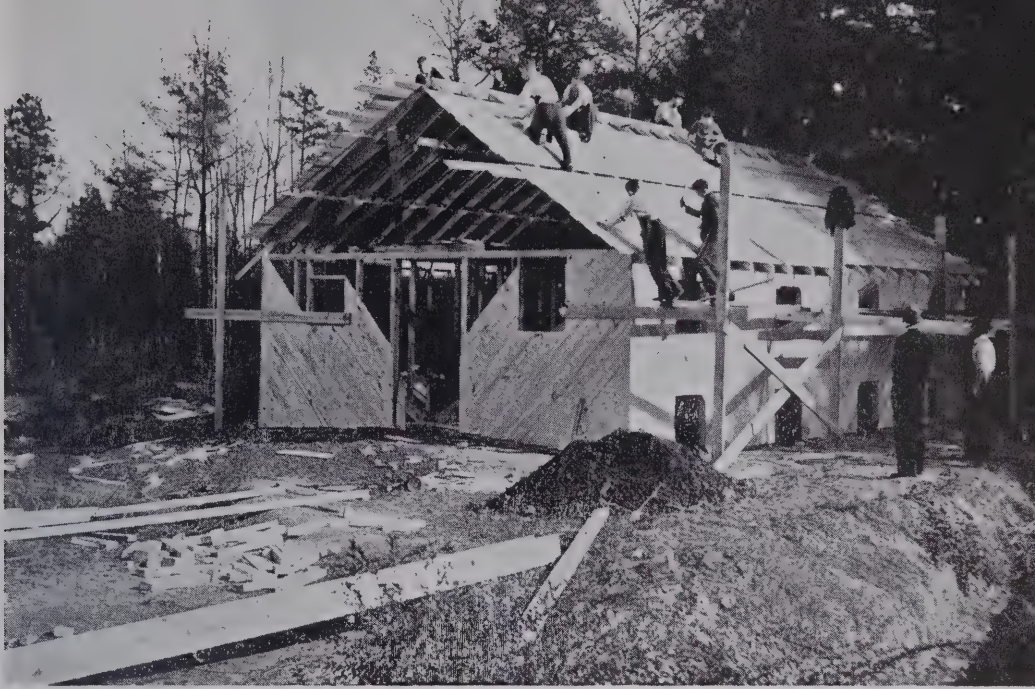
STUDENTS OF VOCATIONAL AGRICULTURE AT WORK IN A RURAL SCHOOL SHOP.
MORE THAN 400 FARM SHOPS ARE NOW OPERATED IN THE RURAL SCHOOLS
OF THE STATE.

THE PROGRAM OF FARM SHOP ACTIVITIES IN THE RURAL SECONDARY SCHOOLS

An attempt has been made to portray with pictures some of the more important activities and experiences of the rural school students in the farm shop as conducted and supervised by teachers of vocational agriculture. The program has expanded greatly during the past two years, partly because of the demand for more shop training to meet the emergency, and partly because of the general increased interest and appreciation of the educational values of this type of work experience in the schools.

Four principal groups of students are now reached through this program: (1) the in-school group, those regularly enrolled in classes of vocational agriculture; (2) the out-of-school group, those enrolled in regular part-time classes in general farm shop; (3) the National defense training group, those out-of-school rural and non-rural youth enrolled for general pre-employment training for the emergency; and (4) the evening-class group of adult farmers, a class now very important because of the vital interest in farm machinery repair. According to the report from the North Carolina State Department of Public Instruction a total of approximately 40,000 individuals were enrolled in these four groups during the year 1942.

The interest of adult farmers is outstanding since most of the rural schools are now provided with equipment adequate for doing all general types of farm repair and construction work. Of more significance is the farmers' increased confidence, gained from doing probably their first satis-



STUDENTS OF VOCATIONAL AGRICULTURE GAIN ACTUAL EXPERIENCE IN SIMPLE FARM BUILDING CONSTRUCTION. THE STUDENTS SHOWN AT WORK IN THIS PICTURE DREW THE PLANS FOR THIS BUILDING, CALCULATED THE BILL OF MATERIALS, PLACED THE ORDER FOR THE MATERIALS, AND DID THE CONSTRUCTION WORK AS AN EDUCATIONAL PROJECT.

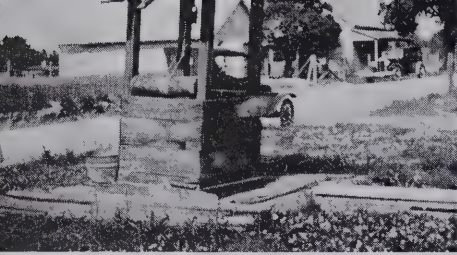
factory repair job of vital concern and worth to them in the successful operation of their farms.

Even the farmer-mechanic of yesterday, the farm operator who is handy with tools, today needs a general refresher course in farm shop in order to maintain or even care for his farm equipment and machinery in this period of rapid change to the mechanization of agriculture.

The farm shop activities in the courses as now organized are drawn largely from the repair and construction jobs necessary for the individual to maintain and improve the farm home, the farm landscape, and the farm equipment, all of which contribute to the satisfaction of living on the farm.

The jobs to do, the problems to solve, and the related materials to study are necessarily left with the teacher and the individual to decide. In general, the more personal the problem, the greater is the progress and the greater are the educational values to be gained. Constructive work in itself is a worthy educational objective. Work coupled with practical problems of one's daily life, furnishes excellent educational experience.

It is hoped that the impetus now given to this program will result in extending to all farm boys and farmers in the State the opportunity to learn to cope with the mechanical problems common to the farm and farm home.



THE NEED

Nothing is very permanent on the average farm. The old well curb at the barn may be in good condition today; tomorrow it is in need of repair.

* * *



The roof to the house may be repaired today; tomorrow it will need other repairs. A piece of weatherboarding will need to be replaced, the blinds will need to be readjusted, and a fresh coat of paint will need to be added.

* * *



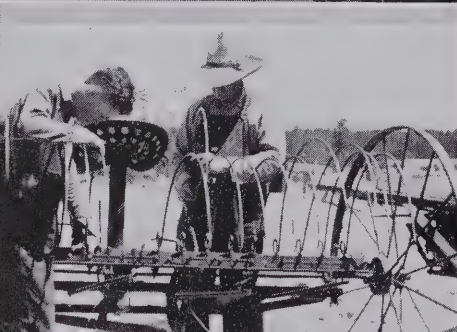
The back door steps will need to be replaced or the porch floor repaired.

* * *



The shed to the barn may be new today but it soon begins to tumble down if not kept in repair.

* * *



The hayrake may need a new tooth. The tongue in the grain drill or mower may split. The bearings in the peanut picker, binder or combine may become worn. Such things take place on all busy farms, creating needs for repair, construction and general maintenance from day to day.

THE FARM SHOP ACTIVITIES

Students of vocational agriculture get actual farm shop practice at school and at home. The construction of a brooder house, a trailer, a farm cart body, a row marker, and the repair of plows and other miscellaneous farm tools and equipment illustrates the farm shop program of one student. Part of this work was done at school and part of it at the farm under the supervision of the teacher of agriculture.

* * *

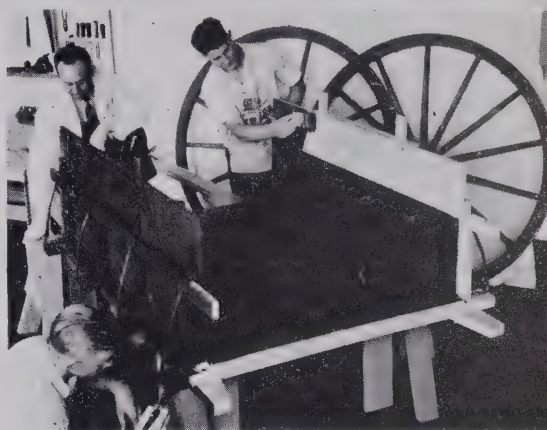
Two students gain vital work experience in the school shop under the supervision of their teacher by constructing a farm cart body for their farm.

* * *

An individual student builds a poultry house on the home farm for the family's poultry flock as a part of his supervised practice program.

* * *

Two students do home repair jobs according to systematic plans previously agreed upon between them, their parents and their teachers of agriculture.





THE NEED

Care of Farm Equipment and Machinery A Vital Educational Problem

Approximately one-third of the total North Carolina farm property is invested in farm buildings, farm machinery and equipment. The pictures on this page illustrate the extreme weather hazards to which farm machines and equipment are too often exposed. Soil erosion is not the only "erosion" on the farm. Farm machines and equipment exposed to snow, rain, hot and dry winds and sunshine "erode" very fast. Necessity for repair work is greatly increased under these conditions. It has been found,* for example, that when mowers are left exposed to the weather, repair expense is increased sixty per cent.

Lack of shelter is not the only reason for this condition. A change of attitude of farm boys and farmers towards a fuller appreciation of the values of better care of farm equipment is equally as important as the shelter. Actual experience in repairing their home farm equipment and machinery through systematic instruction at the school shops is doing much to change the attitude of these farmers and farm boys.

Thousands of the simpler farm machines, tools, and equipment are today being serviced and repaired by the all-day, out-of-school rural youth, and the adult members of the vocational agriculture classes. Members of these classes are learning through actual experience the value of caring for their tools, farm machines, and other farm and home equipment. Thanks are due for the truly democratic educational program that provides for our farm boys in school, our rural youth out-of-school, and our adult farmers an opportunity to learn to meet the problems vital to their daily living.

* Kentucky Agricultural Experiment Station Bulletin 345, Page 247.

THE FARM SHOP ACTIVITIES

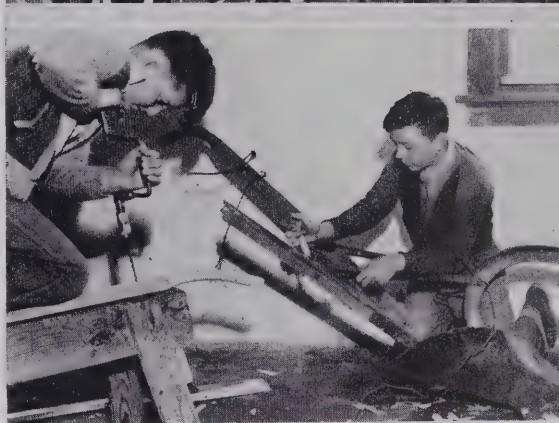
A young farmer, shown standing to the left in the top picture, is talking to his teacher of agriculture about the repair of farm machinery on his home farm. He is a former student of vocational agriculture and a member of a class in farm machinery repair. His experience in farm shop work has prepared him to do the general repair jobs on his farm.

* * *

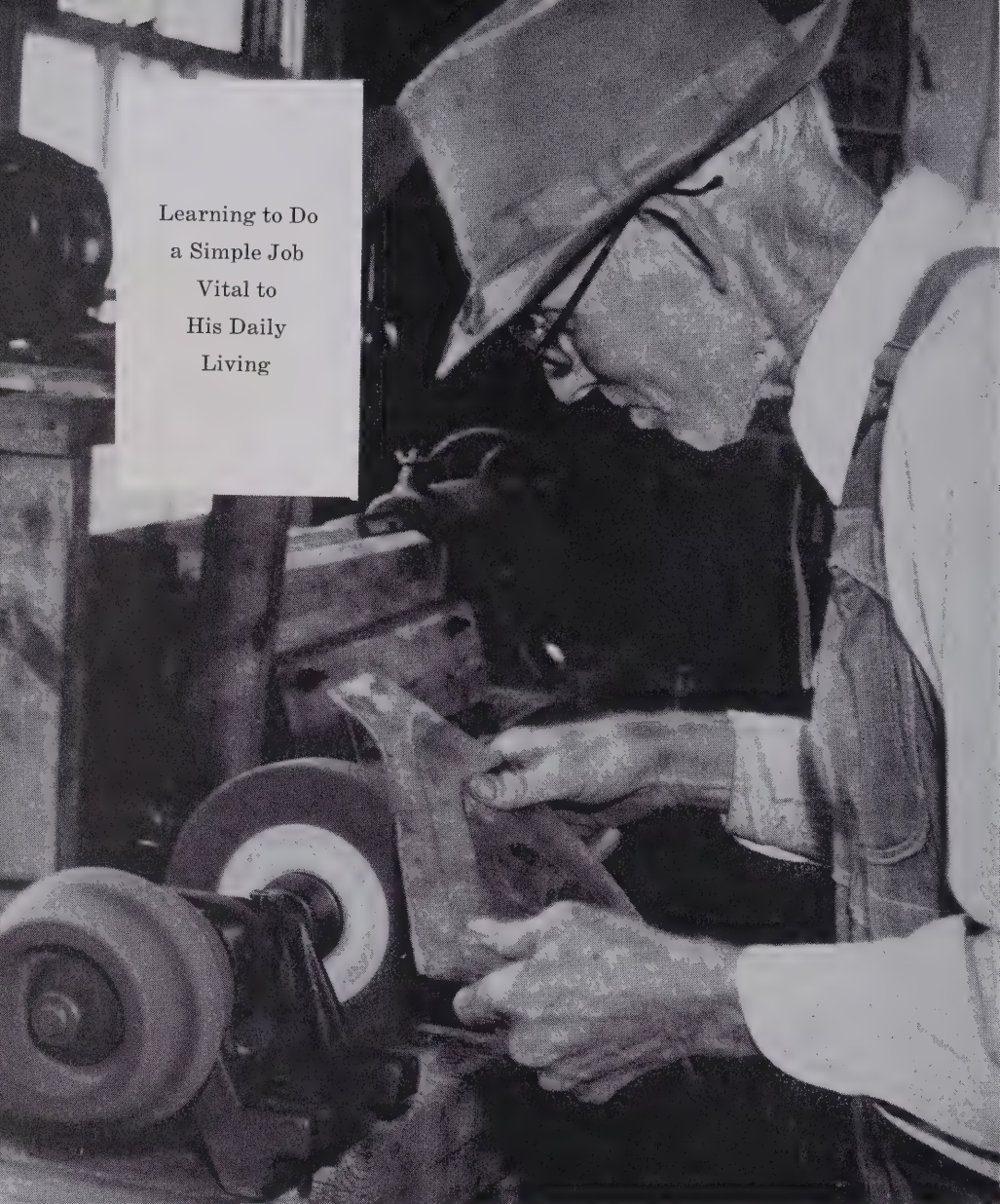
Even the eighth grade student in high school now gets actual experience in learning to make the simpler repairs to his home farm equipment. Two eighth-grade students, in companion pictures to the right, install new plow handles, new metal and wood tie rods, and repaint a two-horse plow in one regular shop period at their local school.

* * *

Out-of-school rural youth take their part-time shop work at the rural schools seriously. The pictures to the right show them repairing a cultivator and a mowing machine for the summer season.



Learning to Do
a Simple Job
Vital to
His Daily
Living



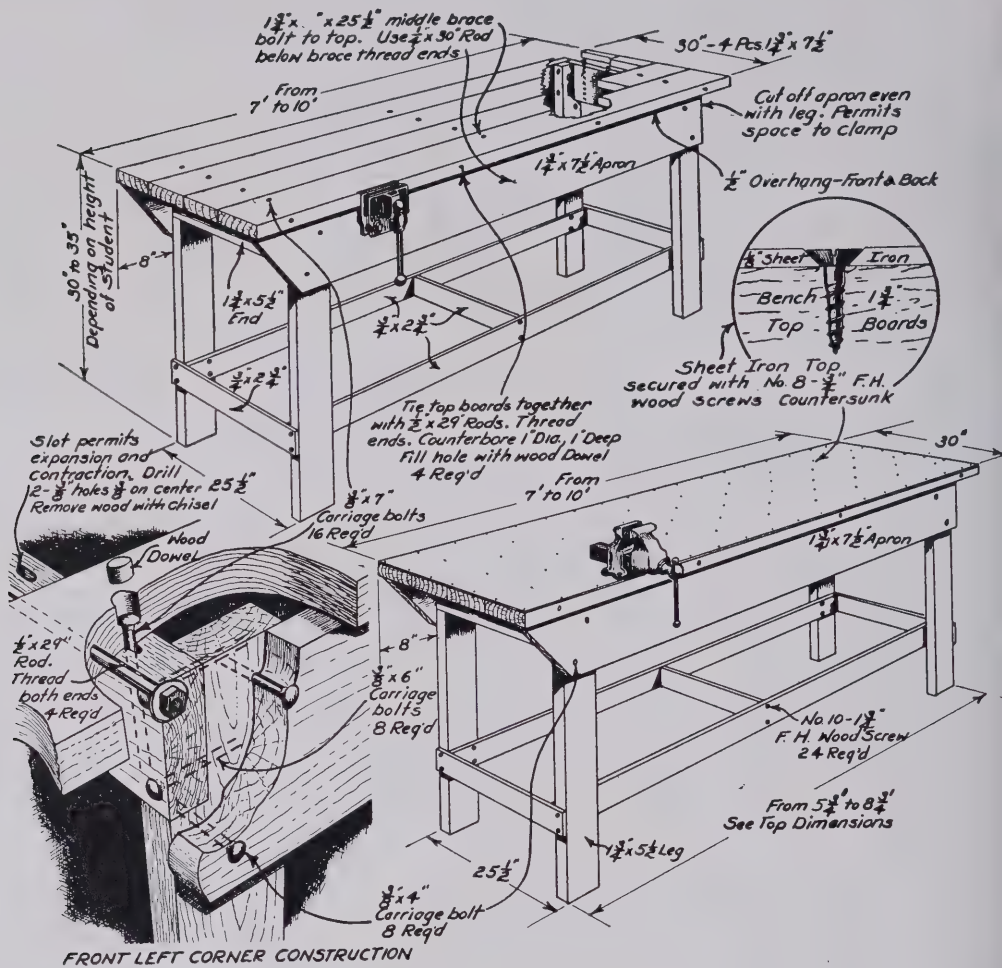
THERE IS AN INCREASING INTEREST IN ADULT CLASSES IN FARM SHOP WORK CONDUCTED IN THE RURAL SCHOOL SHOPS. FARMERS LEARN TO DO REPAIR WORK RANGING FROM THE SIMPLE JOB OF GRINDING A PLOW SHARE TO SUCH JOBS AS THE GENERAL REPAIR OF WAGONS, SEEDERS, DISTRIBUTORS, MOWERS, BINDERS, COMBINES, AND TRACTORS—PROBLEMS VITAL TO THE SUCCESSFUL OPERATION OF THEIR FARMS.

THE FARM SHOP EQUIPMENT

Some Suggested Essentials of The Farm Shop in Rural Schools

- I. **Adequate Space**—Sufficient floor space to serve the usual enrollment in all-day, young farmer and adult farmer classes.
 - A. Generally, from 1800 to 2800 square feet of floor space including storage and tool room.
 - B. About one-fourth of the main shop floor of concrete and the other three-fourths of wood.
 - C. At least 160 square feet of floor space for storage and from 80 to 96 square feet of floor space for tool room.
 - D. Entrance to main shop on ground level and through a door 8' or 10' wide.
- II. **Adequate Equipment**—Sufficient variety to teach the shop jobs farmers of the community should perform.
 - A. See suggested lists and specifications elsewhere in this bulletin.
 - B. In addition to the basic hand tools, include such power tools as:
 1. Heavy grinder with 8" or 10" wheels, 1 H.P.
 2. Drill press, floor model, $\frac{1}{2}$ " chuck.
 3. Bench saw, 12" with 2 H.P. Motor.
 4. Jointer 6" to 8".
 5. Band saw 16".
 6. Forge, build of brick using tuyere iron and blower.
 7. Anvil, from 100 to 200 pounds.
 8. Electric welder, 200 amperes.
 9. Power hack saw, capacity 6" to 8".
 10. Planer, 12" or larger where needs and adequate floor space justify it.
- III. **Equipment and Tools Well Arranged**—Easily accessible for each activity.
 - A. Equipment grouped in areas according to kinds of work to be done, all metal working equipment in area of concrete floor and woodworking equipment in area of wood floor.
 - B. Work benches, well constructed, from 30" to 35" high, metal covered for metal work.
 - C. All power tools controlled by individual switches and mounted on compact individual stands, and constructed to utilize the least possible floor space. *Arrange to provide a distinct isle of travel away from operators of machines.*
 - D. An accessory tool cabinet near each power tool with all accessories conveniently and systematically racked.
 - E. Bench saw, jointer, and planer, located off-center of shop room, all other power tools around or near walls to leave the maximum floor space for student work activities, especially an open assembly space near wide-door entrance.
 - F. All tools in tool room classified and arranged according to kinds and uses, mounted on racks so designed that all tools are readily accessible and easily inventoried.
- IV. **Safety Provisions, Lighting and Ventilation.**
 - A. A separate power circuit (220 V. where possible), with individual outlets for power tools with general central switch that may be locked. Special outlet for electric welder, in a well ventilated area, shielded to protect other workers.
 - B. Adequate windows for natural lighting and ventilation, and sufficient outlets for artificial lighting. Base of windows 42" from floor. Not less than 10 to 15 foot-candles of light at bench height.
 - C. All tools well guarded at all times.
 - D. A metal waste can with lid and supported by metal legs.
 - E. All volatile materials stored in small quantities and in safety containers.
- V. **Miscellaneous**—A blackboard, lavatory, chopping block, trash barrel, sketching table, all conveniently located.

SUGGESTED PLANS FOR WORKBENCHES



MATERIALS REQUIRED

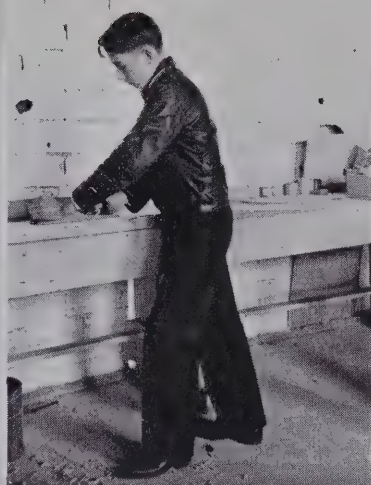
Quantity	Description	Size	Grade and Material
4	Top	1 3/4" x 7 1/2" x (-')	1st choice
2	Aprons	1 3/4" x 7 1/2" x (-')	Select B hardwood
1	Sills	1 3/4" x 5 1/2" x 8'	Air dried or kiln dried
1	Legs	1 3/4" x 5 1/2" x 12'	2nd choice
1	Short braces	3/4" x 2 3/4" x 8'	B or better yellow pine
2	Long braces	3/4" x 2 3/4" x (-')	Air dried or kiln dried
1	Top tension rods	1 1/2" x 10' round	Hot rolled mild steel
1	Center sill rod	1 1/2" x 30' round	Hot rolled mild steel
12	Carriage bolts	3/8" x 7"—with nuts	
8	Carriage bolts	3/8" x 6"—with nuts	
8	Carriage bolts	3/8" x 4"—with nuts	
24	Wood screws	No. 10—1 3/4"	Flat head steel
28	Steel washers	3/8"	
8	Nuts and steel washers	1 1/2"	
2	Nuts and steel washers	1 7/8"	

Add for Metal Working Bench

1	Metal top	1/8" x 30" x (-)	Hot rolled sheet iron
80	Wood screws	No. 8—3/4"	Flat head steel



BENCH TOO HIGH



BENCH RIGHT HEIGHT



BENCH TOO LOW

Benches of different heights should be installed in school shops to meet the needs of students. The above pictures show three different students working at the same bench. The height of the bench is 32½". The heights of the boys, reading left to right, are 63", 67", and 75", respectively. Benches for high school students should range from 30" to 35" in height.

Specifications for Workbenches

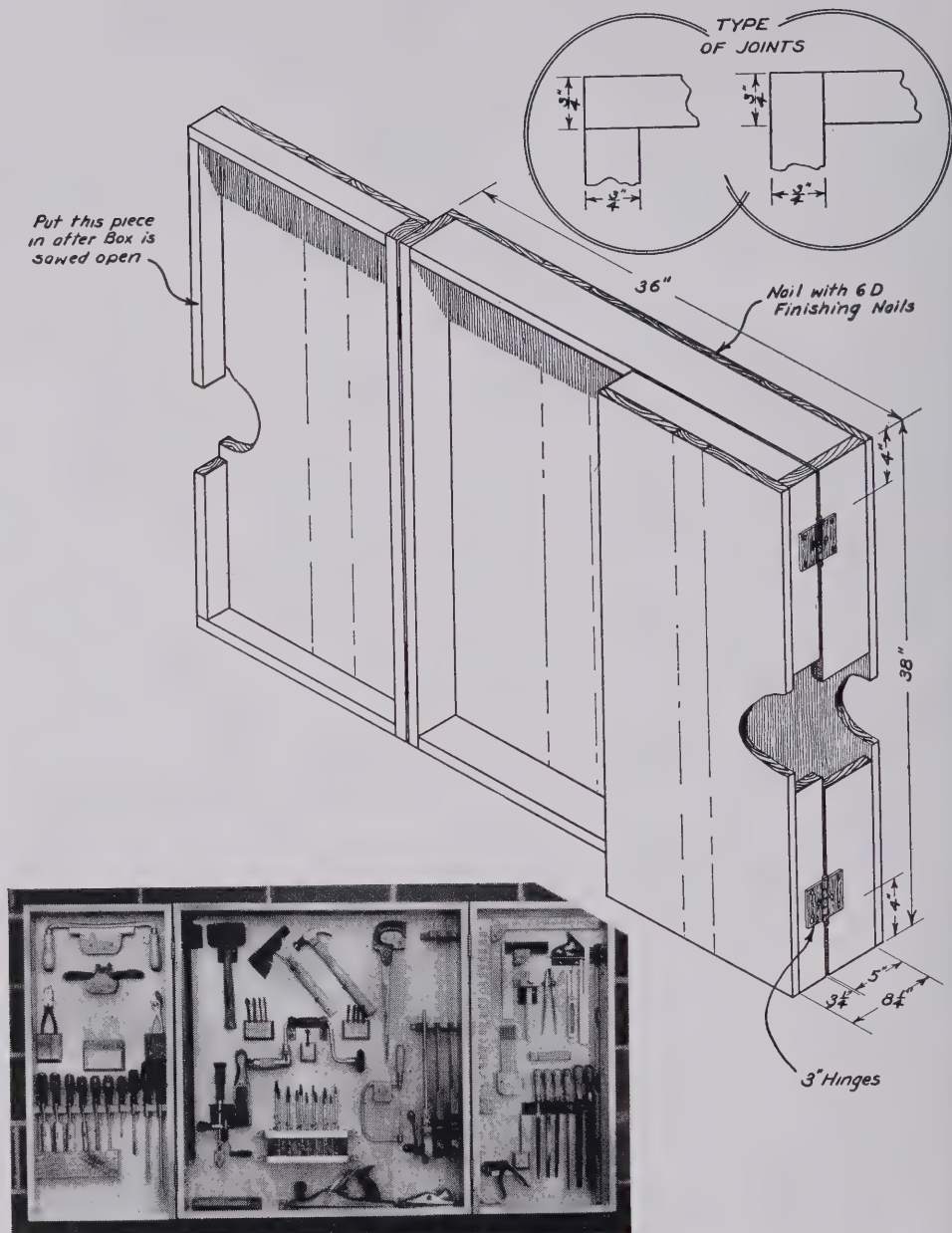
Working drawings for the construction of a good woodworking bench and a good metal working bench are given on the opposite page. The benches are constructed exactly alike with the exception that the top of the metal working bench is covered with sheet iron. This covering insures a smooth even surface that withstands heat, pounding, and rough treatment when doing metal work.

The lengths of the benches should be adjusted to fit best the dimensions of the shop room. The height of the benches should vary for groups of students of different heights. For example, if six benches are required for the shop, two may be built 32" high, two 34" high and one each 30" and 35" high.

The top boards should be accurately fitted, drilled, glued, and bolted together with rods. The top is then bolted to the sills. The holes through the sills should be slotted. These slots permit the top to shrink and to swell due to temperature change without causing cracks to form. The slots are made by drilling two ⅜" holes, ⅜" on center, after which the remaining wood is removed with a sharp wood chisel. The rods through the top tie the four boards together in a strong substantial unit. The rods may be tightened if the boards shrink. The sheet metal top for the metal working bench should be fastened with flat head screws neatly countersunk. Locate the screws in a pattern. The woodworking vise is installed under the front top board so that the vise jaws are flush with the top of the bench. Sometimes it is necessary to add a block between the under side of the top board and the frame of the vise. Notch out the front top board so that the vise frame fits against the front apron. Bolt the vise to the top with carriage bolts countersunk 1" deep. Fill holes with dowels.

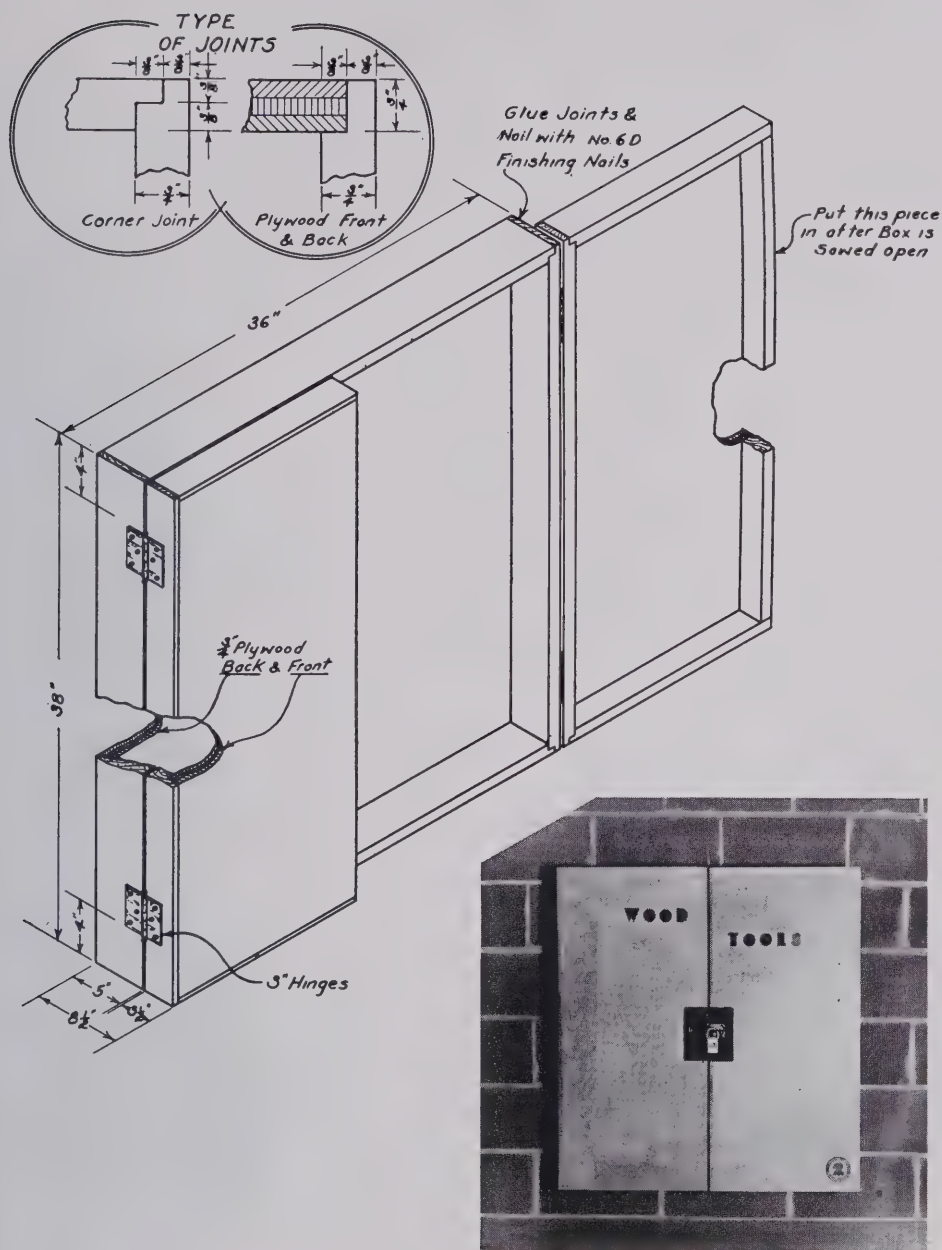
The metal working vise is bolted to the metal and wood top in such position that the stationary jaw face is on a vertical line with the front edge of the bench.

A TOOL CABINET DESIGNED TO BE CONSTRUCTED WITH HAND TOOLS



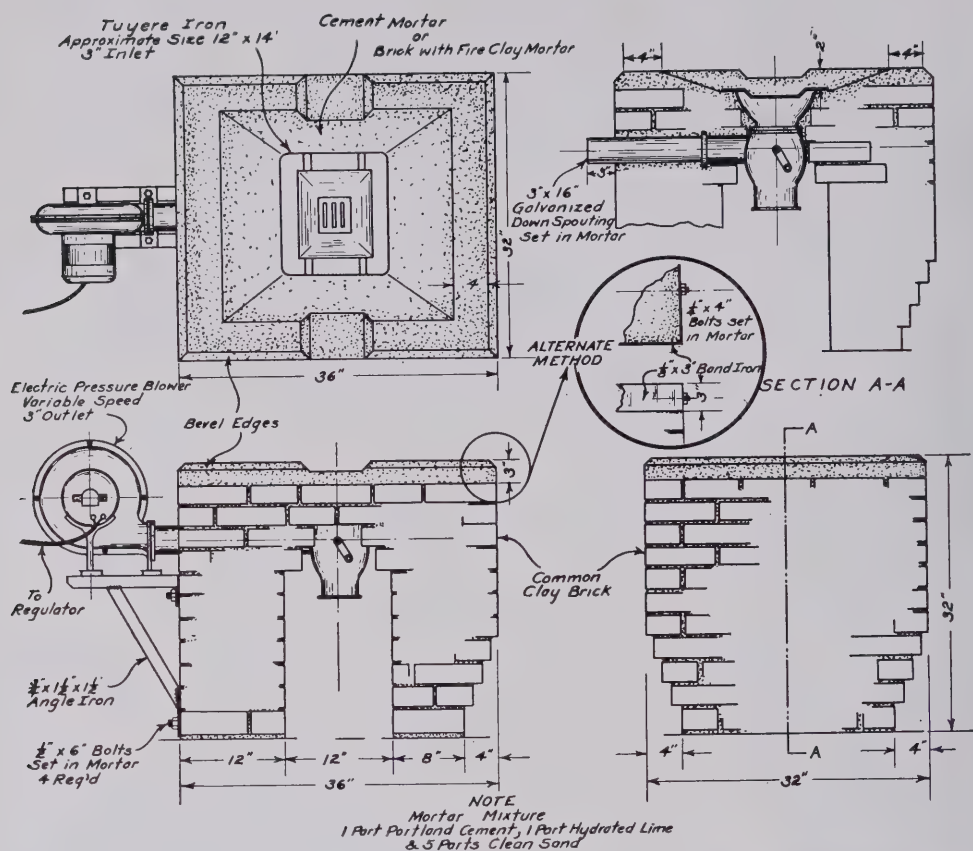
THIS TYPE OF TOOL CABINET ATTACHED TO THE WALL ABOVE THE WORK BENCH PROVIDES EASY ACCESS TO A GENERAL SET OF WOODWORKING TOOLS. IT IS DESIGNED TO BE CONSTRUCTED WITH HAND TOOLS.

A TOOL CABINET DESIGNED TO BE CONSTRUCTED WITH POWER TOOLS

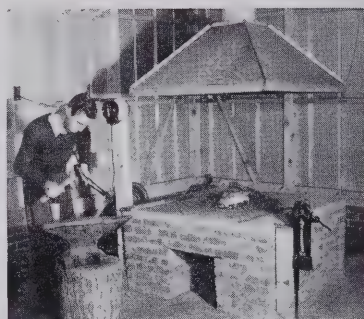


ALL CABINETS AND OTHER SIMILAR SHOP EQUIPMENT CONSTRUCTED WITH POWER TOOLS SHOULD REFLECT HIGH STANDARDS OF WORKMANSHIP. THIS CABINET IS DESIGNED TO BE CONSTRUCTED WITH POWER TOOLS.

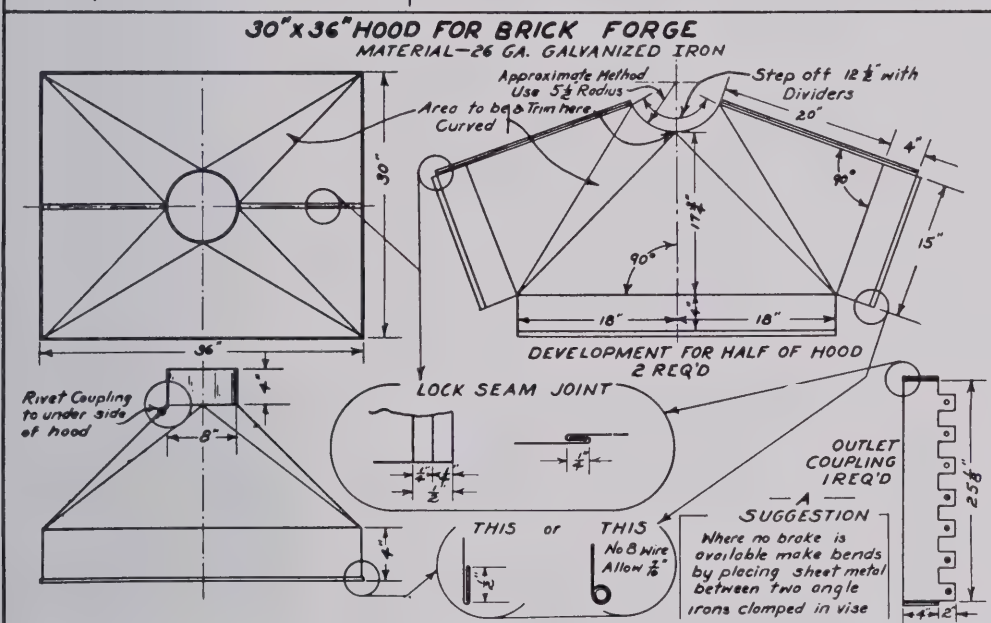
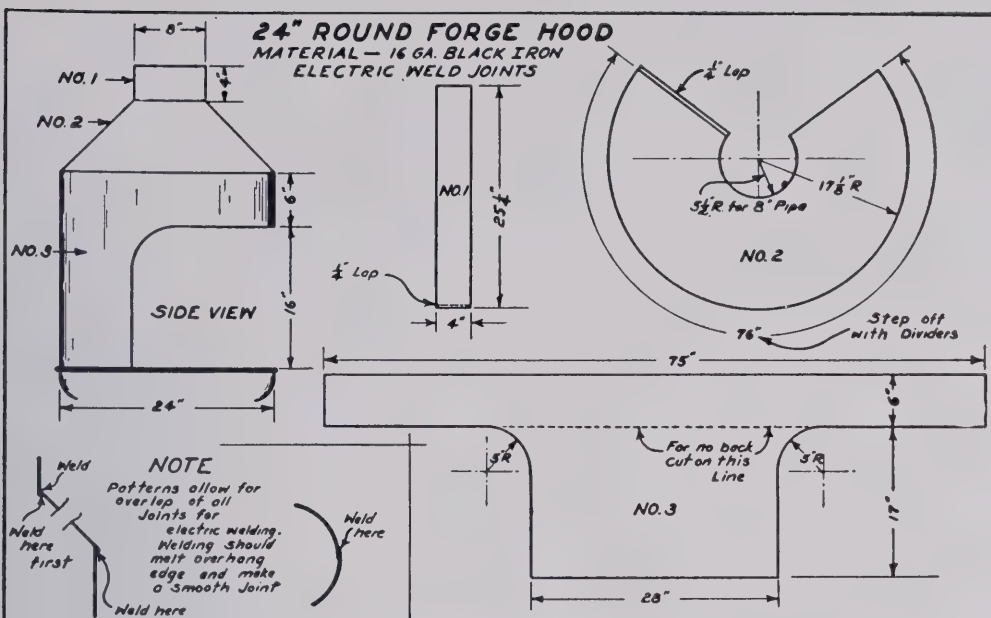
A PRACTICAL FORGE UNIT FOR THE SCHOOL SHOP



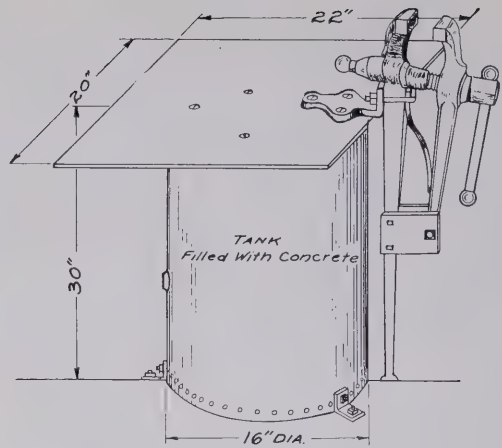
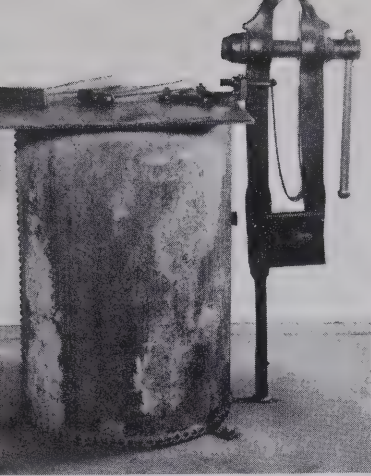
THE ABOVE SPECIFICATIONS ARE FOR THE MIN-
IMUM SIZE UNIT. THE BRICK FORGE SHOULD
BE BUILT ONLY IN SHOPS PROVIDED WITH
ADEQUATE CONCRETE FLOOR SPACE. SEE
SUGGESTED GENERAL SHOP PLANS ON PAGES
34 AND 35.



HOOD LAYOUTS FOR THE FORGE

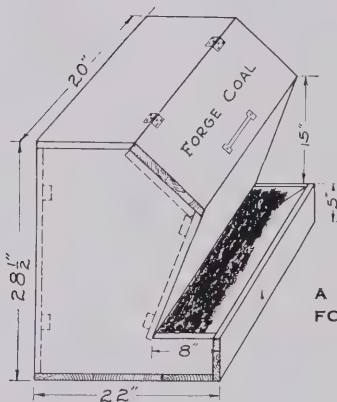


THE SIZE OF THE FLUE AND THE DESIGN OF THE FORGE HOOD ARE VERY IMPORTANT IN SOLVING THE SMOKE PROBLEM. THE FLUE FOR THE FORGE SHOULD HAVE A 12" x 12" FLUE LINING. THE PIPE FROM THE HOOD TO THE FLUE SHOULD BE FROM 8" TO 10" IN DIAMETER AND THE HOOD SHOULD BE AT LEAST AS LARGE AS SPECIFIED ABOVE.



The Leg Vise Base—The vise should have a heavy anchor and should be mounted so that work can be done from all sides. The picture at the top, left, shows such an installation. The anchor for this vise is built of a section of an old hot-water tank filled with concrete with the top made of $\frac{1}{2}$ " steel plate. See the detailed specifications above. The vise is anchored with 8" bolts with the bolt heads extended down into the concrete. The top is anchored by three rods. The top ends of the rods are threaded and fitted into the plate as shown. The lower ends of the rods are crooked and extended down into the concrete twelve inches. Assemble the parts except the vise **upside down**. Fill with concrete. Allow at least three days of wet curing before moving.

The Power Grinder Base—A substantial base for the heavy metal grinder may be constructed by filling a section of an old discarded water tank with concrete capped with water vats of sheet metal as shown below. Bolts for anchoring the grinder are correctly spaced and set in the concrete when poured.

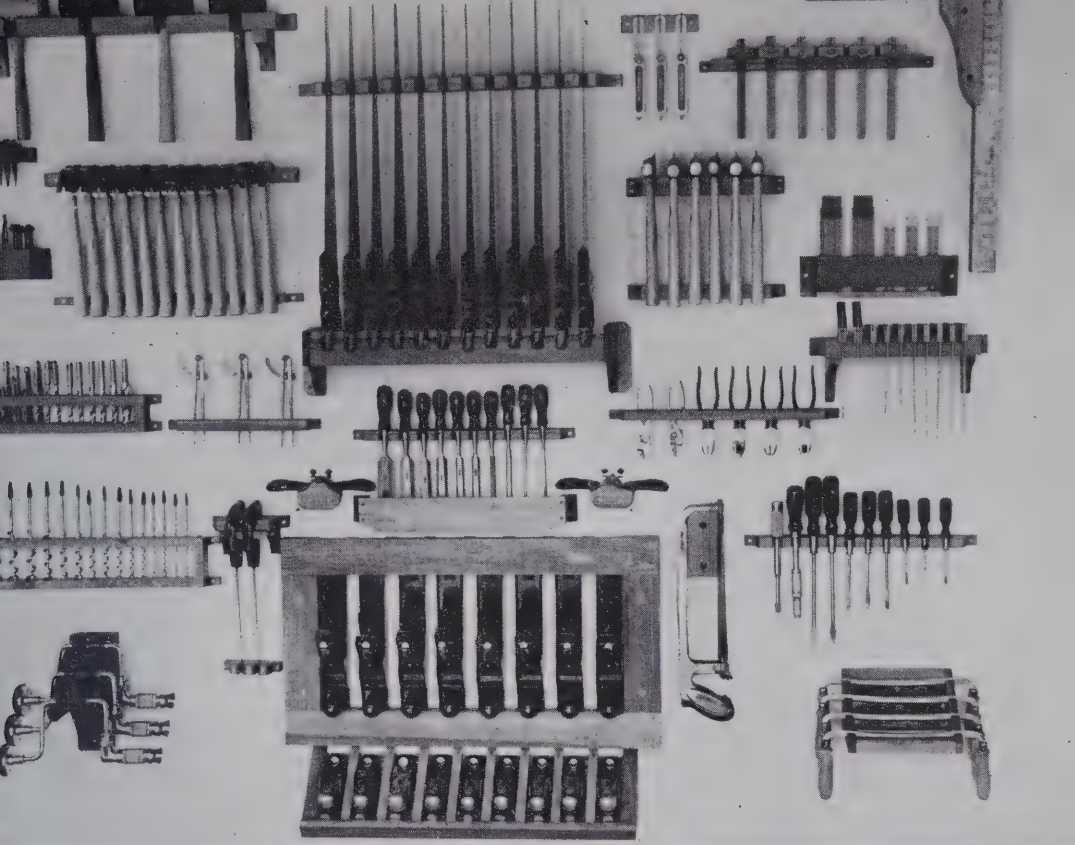


COAL BIN FOR FORGE

A SUBSTANTIAL BASE
FOR HEAVY GRINDER.

A HANDY COAL BIN
FOR THE FORGE UNIT.





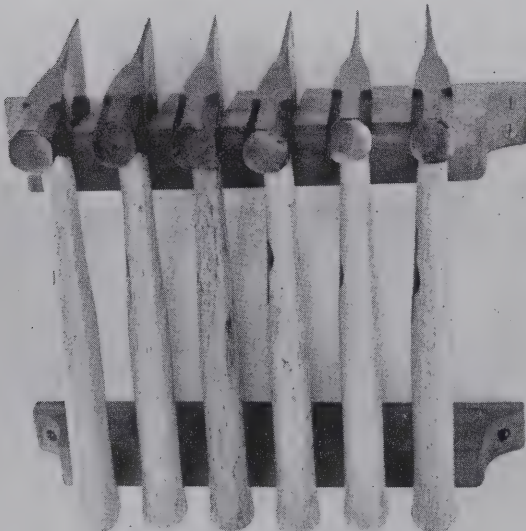
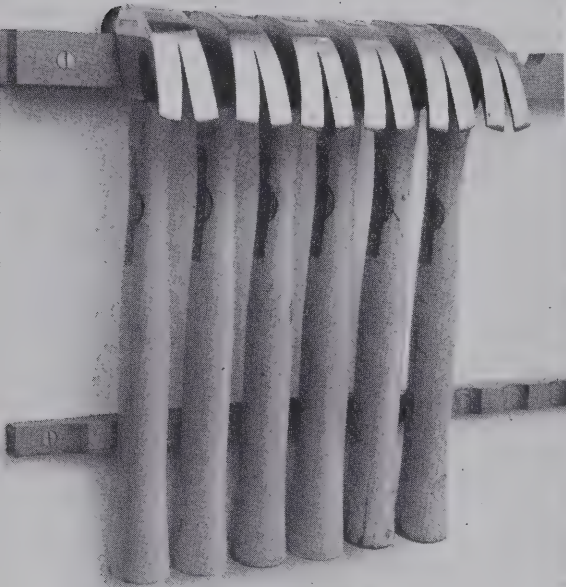
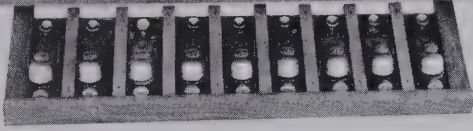
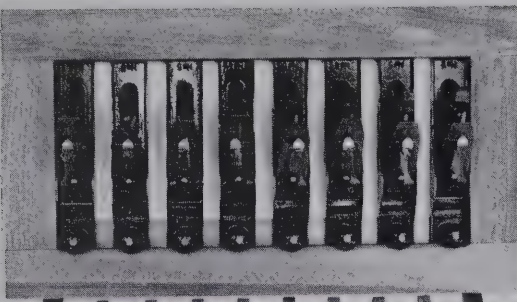
MOUNTING TOOLS

Tools may be mounted on a panel in the central tool room, in cabinets convenient to the workbench, and in accessory cabinets near the power tools. The above panel illustrates a practical and well organized method of caring for woodworking tools in the central tool room.

Regardless of the actual method employed, certain guiding principles should be followed:

- a. Classify all tools according to kinds and uses.
- b. Design each individual rack at least large enough to mount all tools of a given kind.
- c. Rack all edge tools in such a way that the cutting edges will be safeguarded from dulling and from injuring students.
- d. Assemble and mount all racks with wood screws so that they be moved easily when a rearrangement is desired or when the shop equipment is to be moved from old quarters to a new shop. Over 200 shops in the State have been enlarged and improved during the past two years. If this principal had been followed, the problem of setting up a new tool room and remounting the tools would have been reduced to a minimum.
- e. The tools should be racked so that they can be easily taken from and be returned to the racks.
- f. By all means, have a system to follow and follow it.

The individual racks displayed on the following pages may be adapted for use in the tool room or for use in the tool cabinet.



INDIVIDUAL TOOL RACKS

Specifications for the racks shown here are given on the next page.

* * *

The jack plane rack is built of finished 2" x 4" stock. The top and bottom pieces of the jack plane rack can best be cut out with the dado head on circular saw.

The block plane rack just below is built of $\frac{3}{4}$ " boards. The plane rests in the rack so that the cutting edge does not touch the wood.

* * *

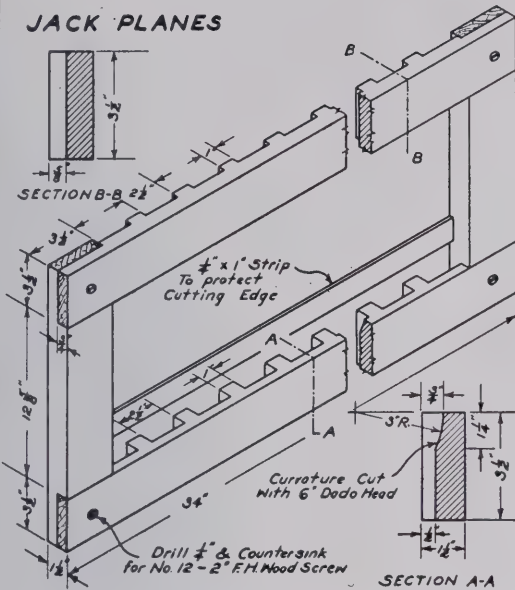
The nail hammer rack is constructed from one piece of wood which is sawed open after the $\frac{7}{8}$ " holes are bored.

* * *

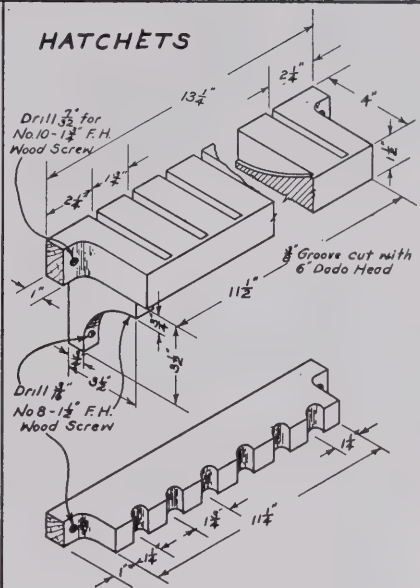
The grooves in the top piece of the hatchet rack are easily cut out with a dado head on a circular saw. Both the hammers and hatchets are taken from the racks by a light lift upward.

SPECIFICATIONS FOR INDIVIDUAL TOOL RACKS AS SHOWN ON THE OPPOSITE PAGE

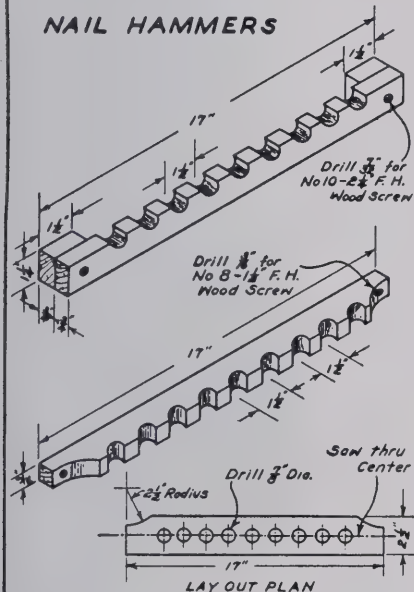
JACK PLANES



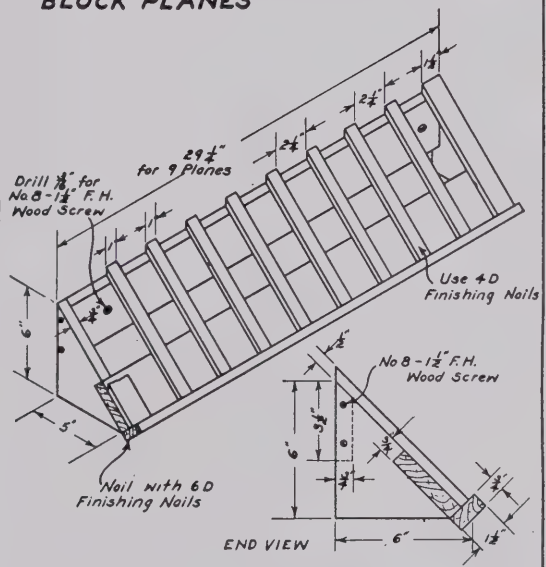
HATCHETS

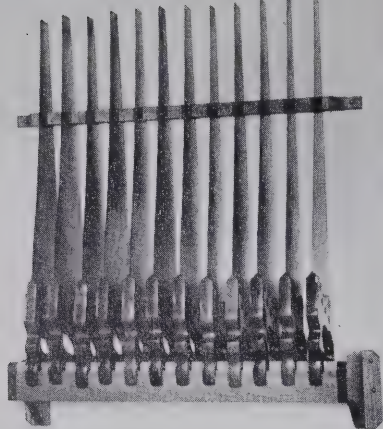


NAIL HAMMERS



BLOCK PLANES





INDIVIDUAL TOOL RACKS

Specifications for the racks shown here are given on the next page.

* * *

This saw rack is very compact and the saws may be taken out and may be replaced in the rack very easily without touching the saw blades. The spacing blocks which separate the saws are cut from a strip set into a dado groove in the rack base. The 8d. finishing nails are set in the strip before cutting out between the blocks.

* * *

Just a slight pull to you and you have a try square or combination square free from this rack.

* * *

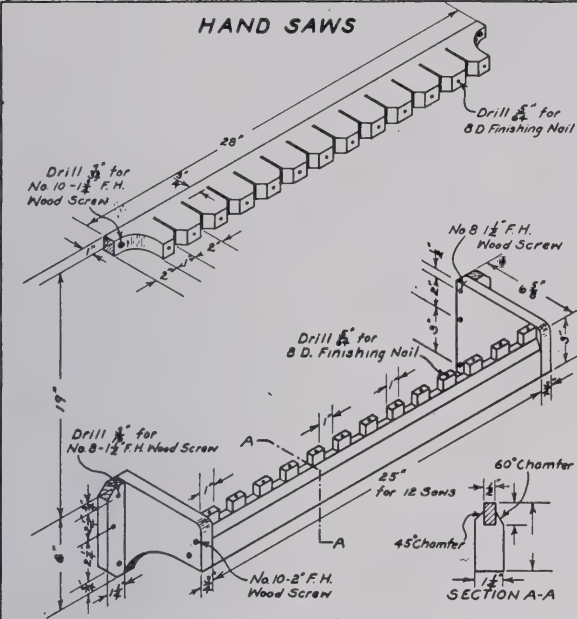
It takes no more wall space for six squares than it does for one on this type of rack.

* * *

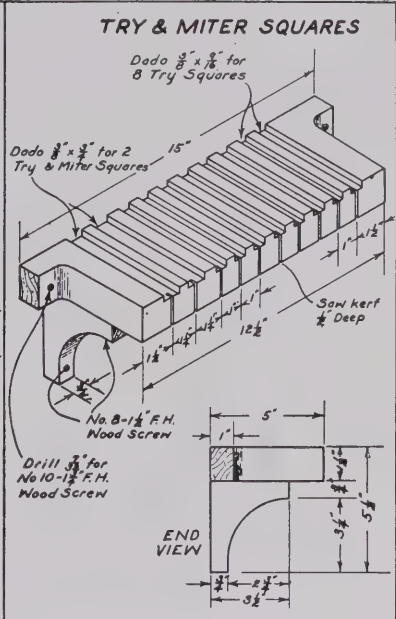
Cut the concave rest to fit the mallet. This may be done by running the rack strip diagonally over a circular saw. Use a guide clamped to the table top of the bench saw when making this cut. Make several shallow cuts in doing this job.

SPECIFICATIONS FOR INDIVIDUAL TOOL RACKS AS SHOWN ON THE OPPOSITE PAGE

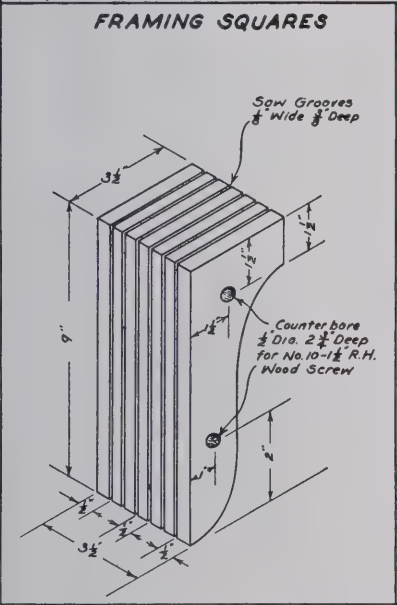
HAND SAWS



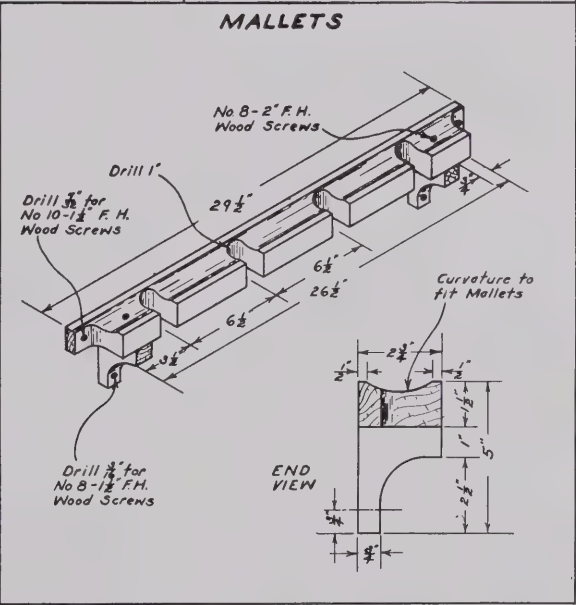
TRY & MITER SQUARES

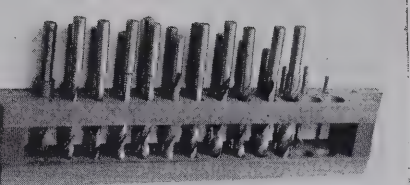


FRAMING SQUARES



MALLETS

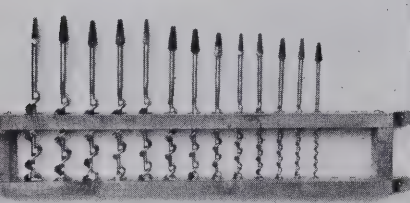




INDIVIDUAL TOOL MOUNTS

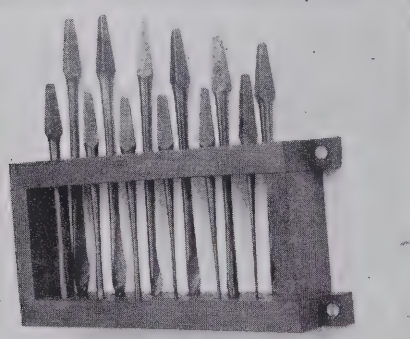
Bore holes one size larger than the bits to be placed in them, construct as shown and the result is a rack that protects the points of machine spur bits.

* * *



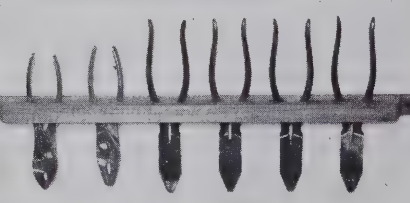
Auger bits may be racked by the same method.

* * *



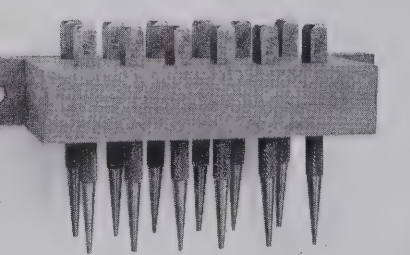
Maybe those gimlet bits are not used often. For that reason it is well to have a definite place for them.

* * *



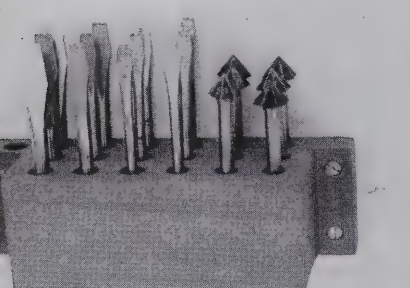
Bore three holes of proper sizes to form a slot in a 2" strip of $\frac{3}{4}$ " wood, chisel out the slots, hang the strip by means of wood screws and drop the pliers in the slots.

* * *

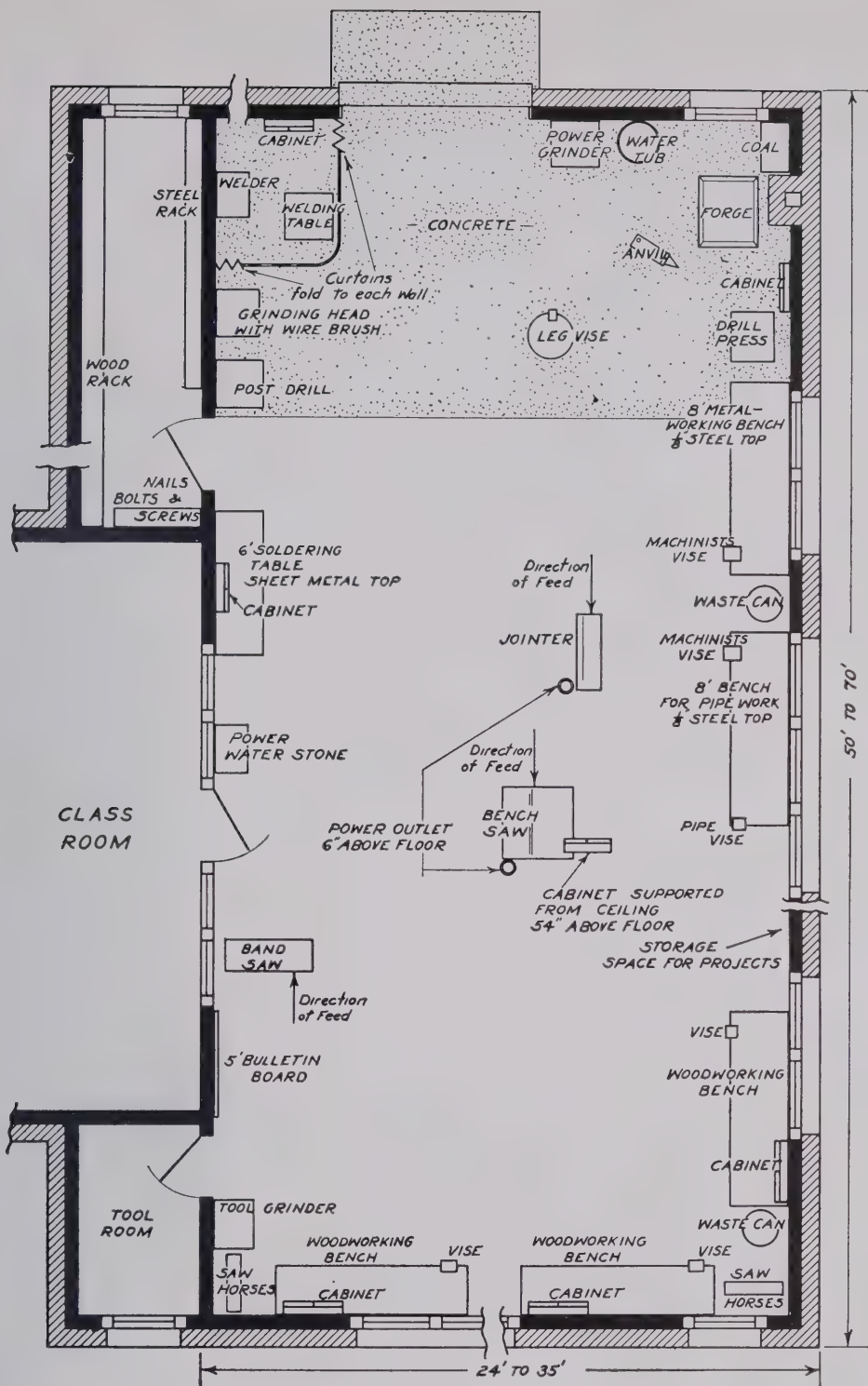


Just a few holes through a 2" x 4" block, shaped as shown and hung with wood screws, and you have a place for those "flecting" nail sets.

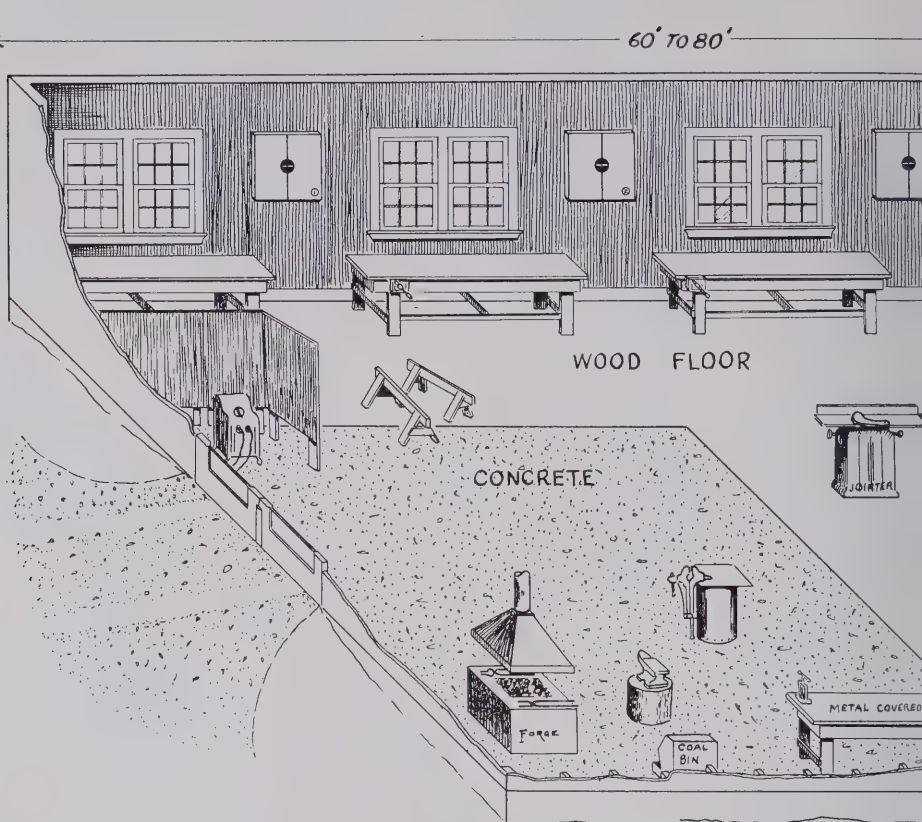
* * *



A little thicker block should be used for the screw driver bits and countersinks.



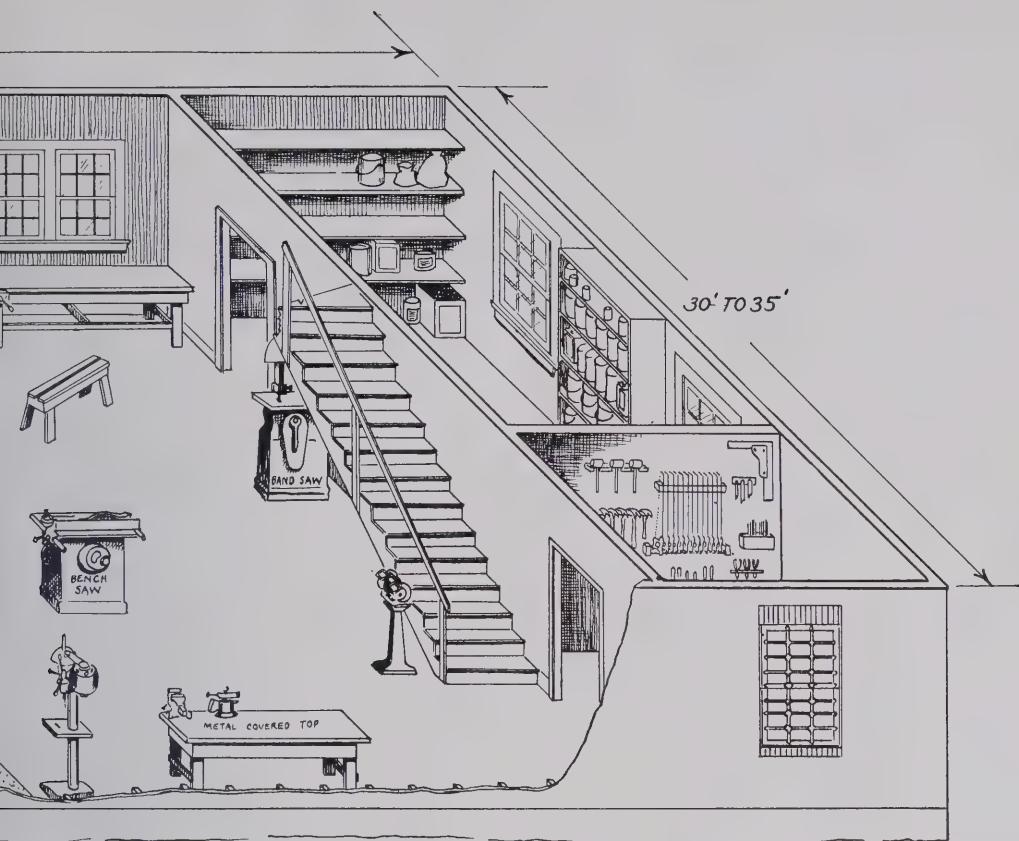
SUGGESTED PLAN
FOR ARRANGING SHOP EQUIPMENT



FOR A

1. ABOUT ONE-FOURTH OF THE MAIN SHOP FLOOR SHOULD BE OF CONCRETE AND THE OTHER THREE-FOURTHS SHOULD BE OF WOOD.
2. ADEQUATE STORAGE SPACE AND TOOL-ROOM SPACE SHOULD BE PROVIDED IN EVERY SCHOOL SHOP.
3. ENTRANCE TO THE MAIN SHOP ROOM SHOULD BE ON THE GROUND LEVEL IF POSSIBLE, AND THROUGH A DOOR EIGHT TO TEN FEET WIDE.
4. EQUIPMENT SHOULD BE GROUPED IN AREAS ACCORDING TO THE KINDS OF WORK TO BE DONE.

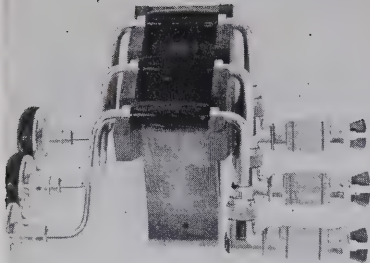
9. WRITE THE DIVISION OF
DEPARTMENT OF PUBLIC
WORKS FOR SUGGESTED BLUE
PRINT SHOPS.



SUGGESTED PLAN WORKING SHOP EQUIPMENT

5. ALL POWER TOOLS SHOULD BE MOUNTED ON INDIVIDUAL STANDS AND SHOULD BE CONTROLLED BY INDIVIDUAL SWITCHES.
6. GUARDS AND OTHER SAFETY MEASURES FOR ALL POWER TOOLS SHOULD BE PROVIDED AT ALL TIMES.
7. THERE SHOULD BE ADEQUATE WINDOWS FOR NATURAL LIGHTING AND VENTILATION, AND SUFFICIENT ARTIFICIAL LIGHTING TO PROVIDE FROM 10 TO 15 FOOT-CANDLES OF LIGHT AT WORKBENCH HEIGHT.
8. FOR FURTHER SUGGESTIONS SEE PAGE 19.

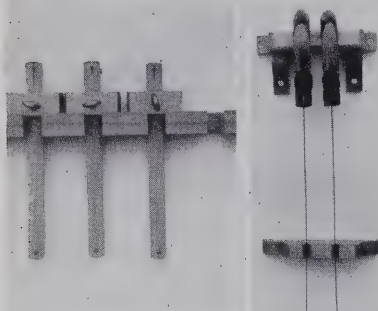
COOLHOUSE PLANNING, STATE
CONSTRUCTION, NORTH CAROLINA,
FOR VOCATIONAL AGRICUL-



INDIVIDUAL TOOL RACKS

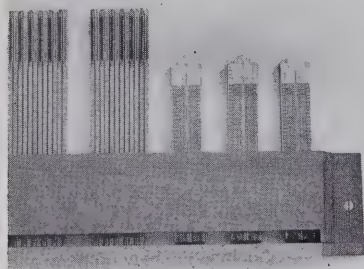
Specifications for the racks shown here are given on the next page.

* * *



An attractive rack for braces that requires little wall space.

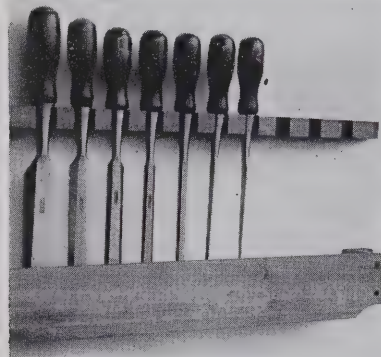
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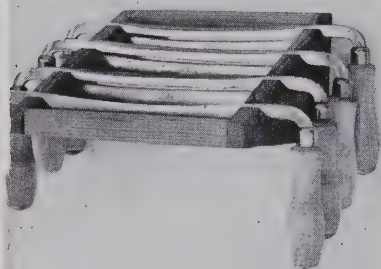
"Where did I put that rule yesterday?" Maybe a rack like this would help you find it next time.

* * *



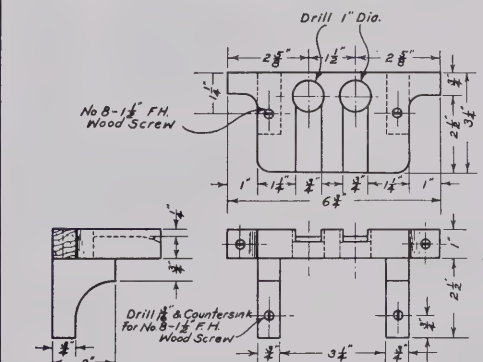
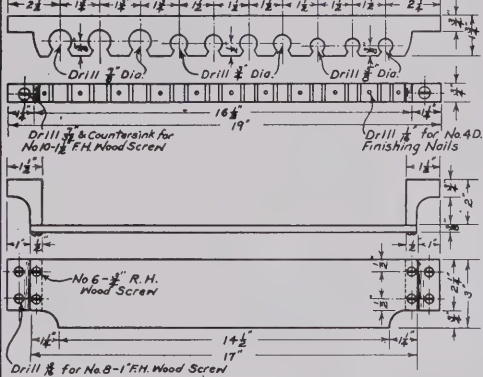
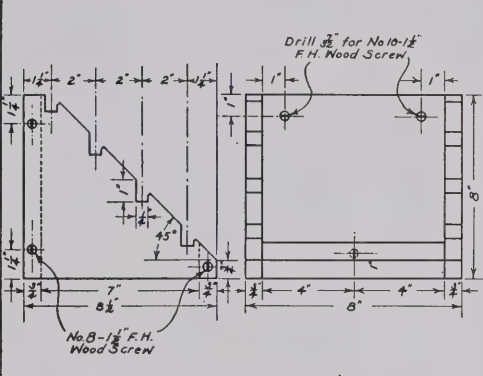
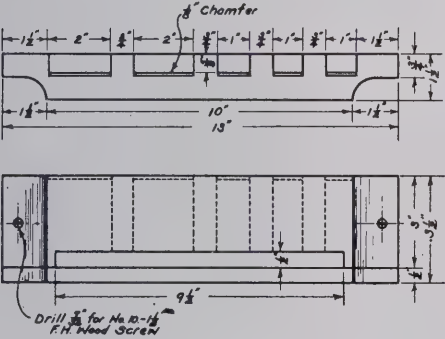
Use finishing nails to re-inforce the wood between the notches of the chisel rack. Be sure to drill small holes for the nails. Set the nails before boring and cutting out the notches for the chisels.

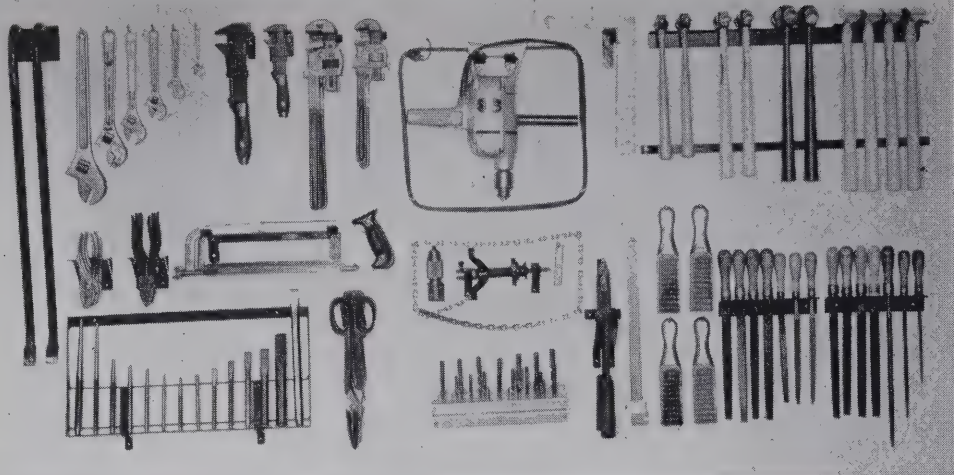
* * *



Four draw knives take the same wall space as one when racked by this method. The cutting edges are protected.

SHOWN ON THE OPPOSITE PAGE





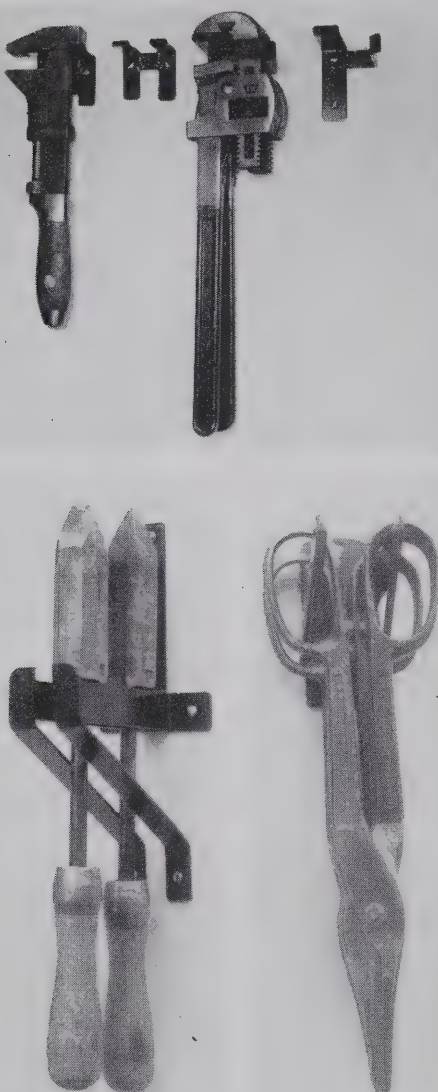
RACKING METAL WORKING TOOLS

The above panel illustrates an excellent arrangement for metal working tools.

* * *

Close-up of pipe and monkey wrench racks made of $\frac{1}{8}$ " x $\frac{3}{4}$ " flat iron. The shape of an empty rack may be observed to the right of each wrench. The metal pieces are put together by an electric weld.

* * *



The same type of flat iron is used in constructing hangers for the soldering iron and tin snips. Measure accurately for all the cuts and bends. To make a square bend, clamp the metal in a machinist vise at right angles to the top of the vise jaw face.

INDIVIDUAL TOOL RACKS

The top piece of this metal hammer rack is made of 1-½" angle iron. The machinist hammers are supported with curved pieces of 5/16" rod iron electric welded to the top front edge of the angle iron. The blacksmith hammers are separated and supported by short strips of flat iron also electric welded to the top front edge of the angle iron.

* * *

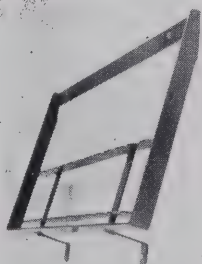
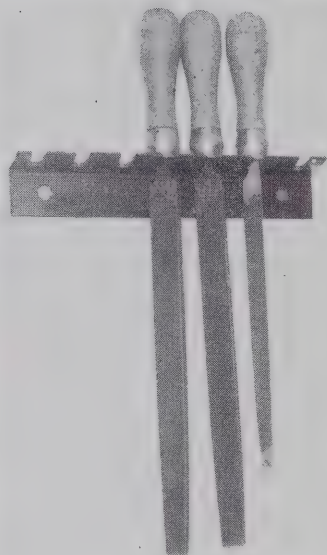
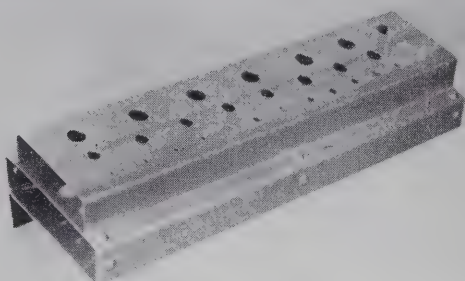
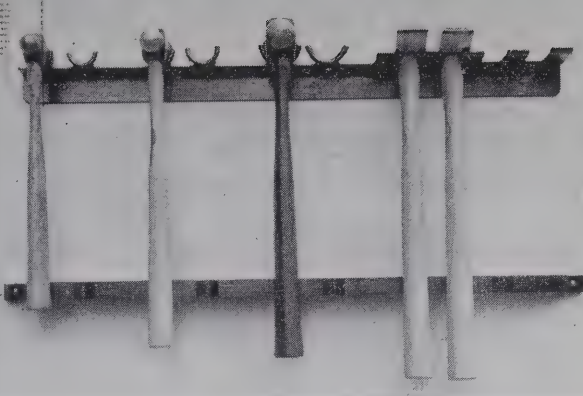
A wall bracket for twist drills. Construct of about 24-gauge sheet metal.

* * *

Four pairs of pliers take the same wall space as one pair when racked by this type of metal hanger. Use screw-on file handles when hanging files by a notched piece of angle iron shown to the right. The outer edge is bent slightly upward to prevent the files from falling.

* * *

Notch out spaces in the edges of the flat iron the sizes necessary for the cold chisels and punches. Use ½" x 1" flat iron, construct and hang as shown. This rack is trash free. The entire tool is clearly visible.



IDEAS

1. A substantial anvil base with hardie and hammer racks. See specifications on opposite page.

* * *

2. A vertical rack for storing steel. The base is made of wood stalls. Short lengths of pipe set in the wall about seven feet high separate the long pieces. This rack is satisfactory for lengths up to ten feet.

* * *

3. A portable rack for blacksmith's tools. This rack is very convenient where two or more forges are available.

* * *

4. A horizontal metal rack made of angle iron and attached to the wall of the storage room.

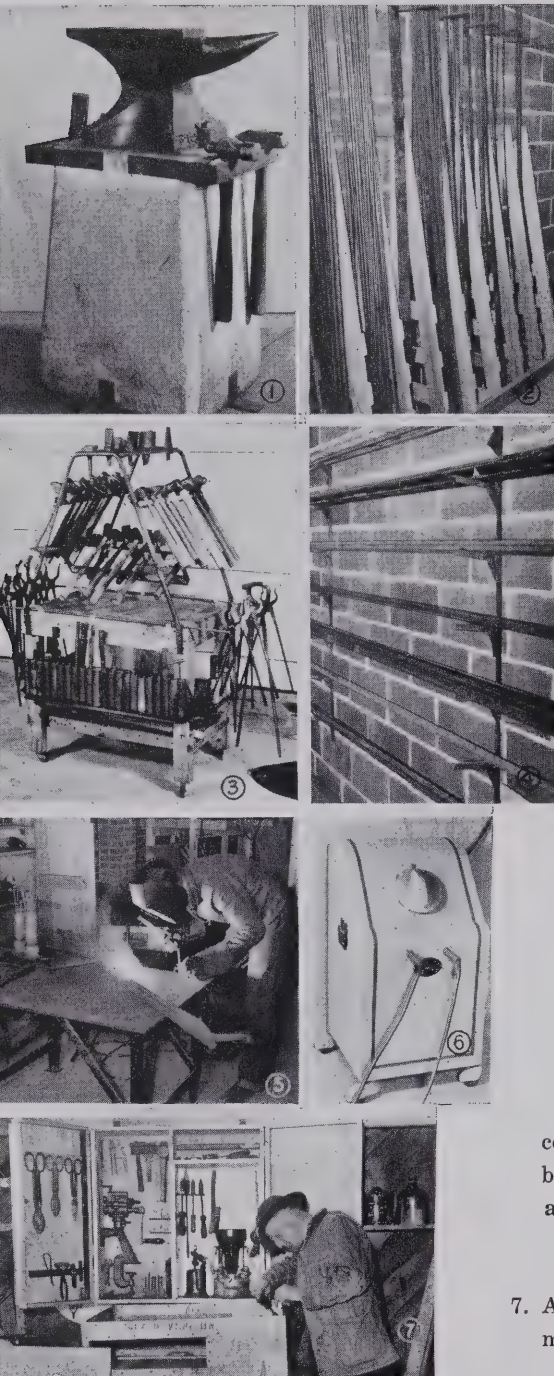
This type is not as convenient as the vertical type shown in picture above, but is very practical for racking iron of long lengths. Fasten rack to the wall with lag screws and lag screw expansions.

* * *

5. and 6. Electric welders are now essential equipment in rural school shops. A convenient welding table constructed like the one at the left may be built of two-inch angle iron for the frame and steel or cast iron plate for the top.

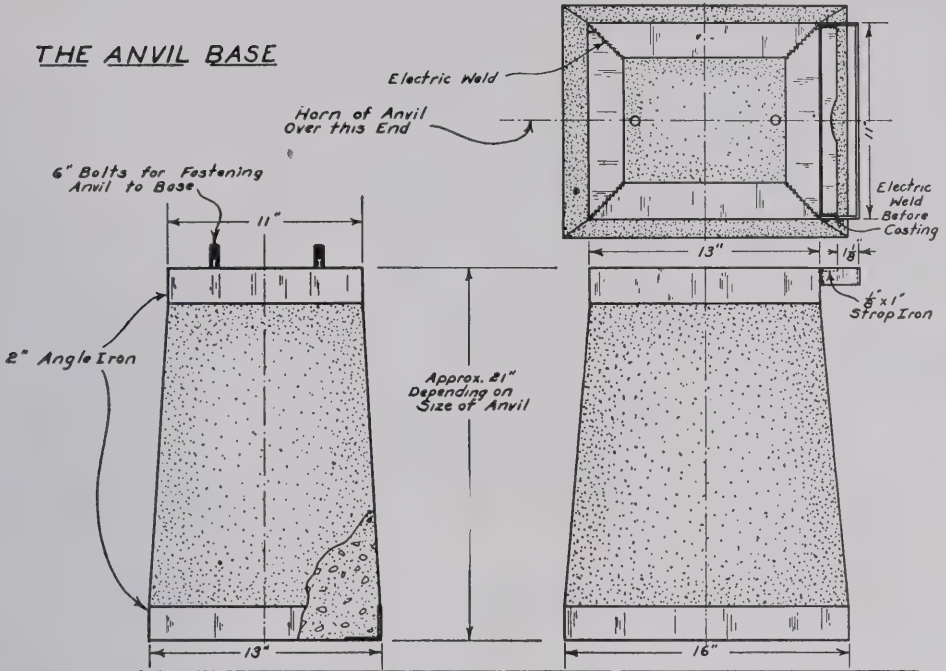
* * *

7. A convenient method of racking sheet metal tools over the work bench.



SPECIFICATIONS FOR ANVIL BASE AS SHOWN AT TOP OF OPPOSITE PAGE

THE ANVIL BASE



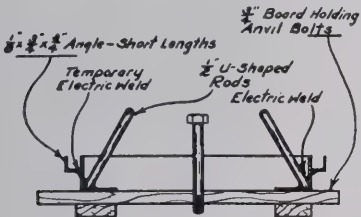
THE FORM

STEP NO.1

Cut and Weld Top and Bottom Angles per Dimensions Above

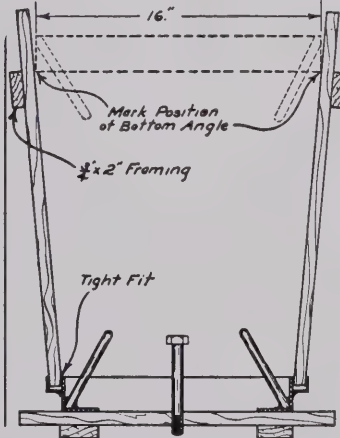
STEP NO.2

Locate Holes for Anvil in a Board 11"x13"
Drill Holes and Insert 6" Bolts
Weld 1/2" U-Shape Rods To Inside of Top & Bottom Angles
Weld Temporary 1/2" Angles To Outside of Top Angle
Place Top Angle in Position. Base Will be Cast Upside Down



STEP NO.3

Build Form of 1/2" Wood or 1/2" Plywood
Coat all Wood Parts with Clean Lub.Oil



STEP NO.4

Fill with Concrete to Position of Bottom Angle
Place Bottom Angle in Position

Complete Filling with Concrete

CONCRETE MIXTURE

- Mixture for Thin Layer of Mortar on Top & Sides
1 Part Cement
2 Parts Screened Sand
- Regular Mixture
1 Part Cement
2 Parts Sand
3 Parts 1/2" Coarse Aggregate
Clean Water to Give Workable Mixture

IDEAS

1. There should be a definite place for a miter saw. This is a substantial, yet an easily constructed table for this purpose. See specifications on opposite page.

* * *

2. A portable circular saw clamp for use in holding circular saws of different diameters. Pressure on the saw is secured by clamping it in an ordinary woodworkers vise as shown.

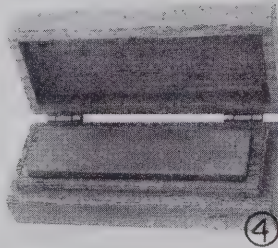
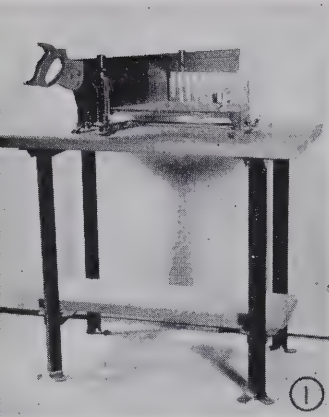
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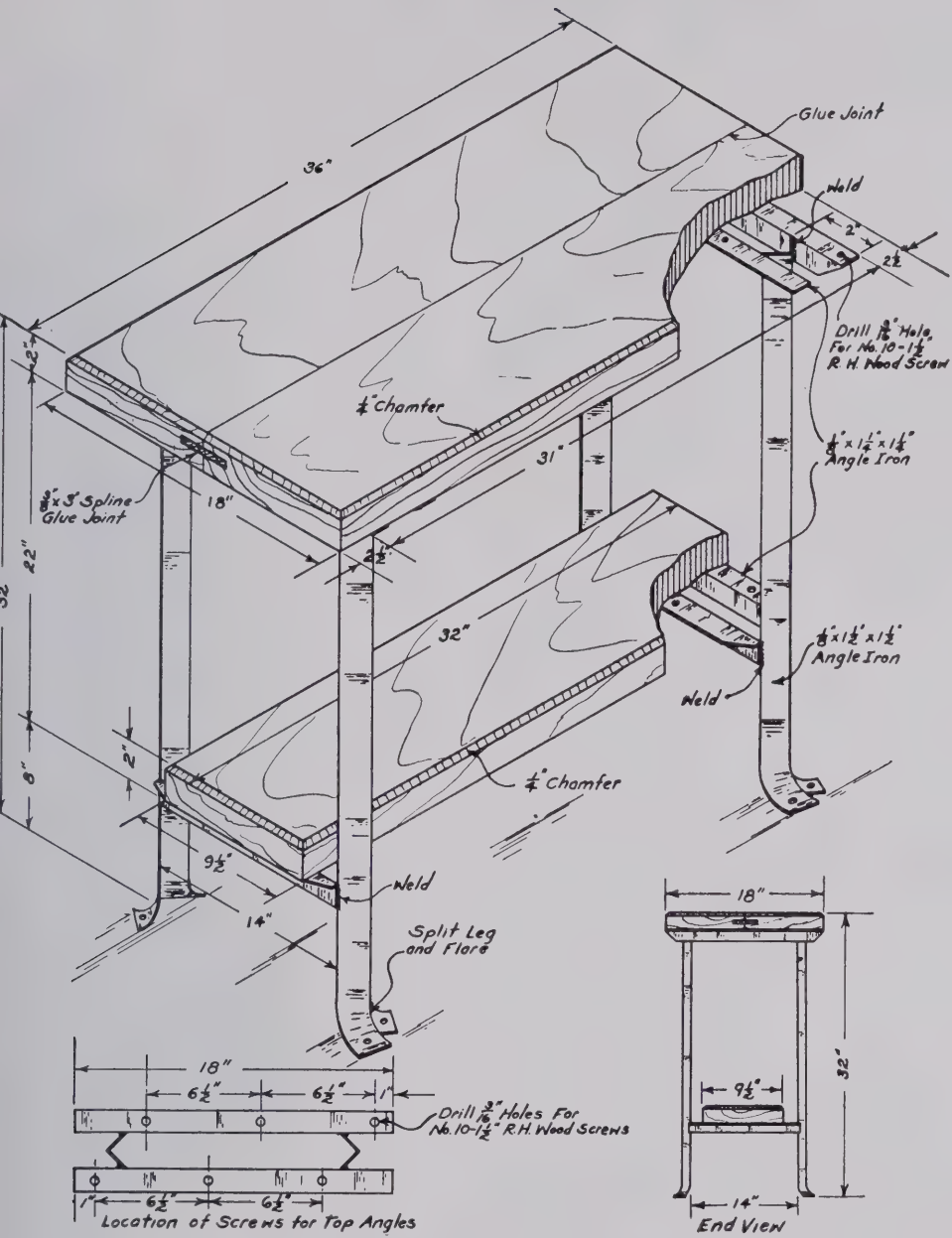
3. At least one sketching table should be available somewhere in the shop. This type is easily constructed of angle iron with a sloping desk top of wood. The drawing board forms the top of the sketching table and is hinged near the back.

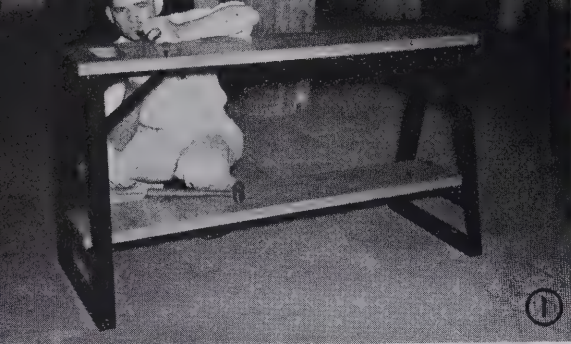
* * *

4. A simple housing for the oil stone, built out of a block of wood with base and lid mortised out for the stone as shown. Such a method protects the stone from dust and from breaking if it is dropped on the floor.



SPECIFICATIONS FOR MITER SAW TABLE SHOWN AT
TOP OF OPPOSITE PAGE

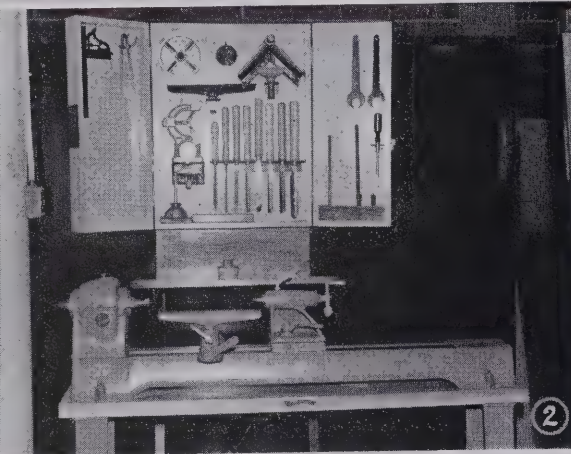




IDEAS

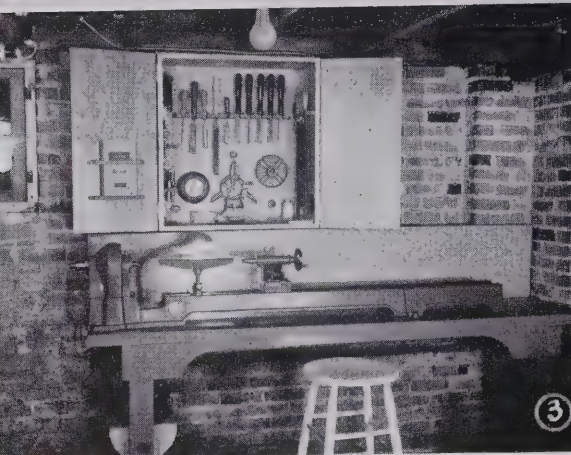
1. A wood lathe table built of angle iron and wood boards. See specifications on opposite page.

* * *



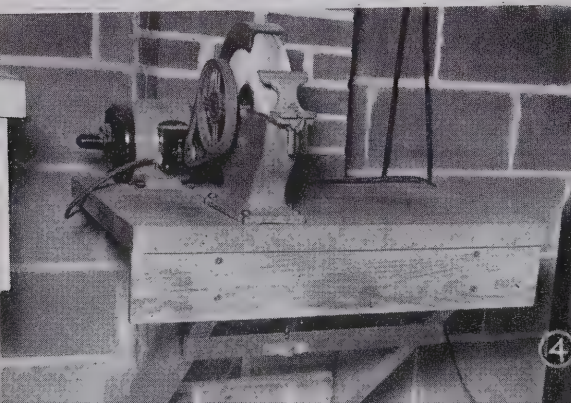
2. A wood lathe accessory cabinet mounted on the wall back of the lathe provides easy access to all tools and accessories. The cabinet may be closed and pad-locked when not in use.

* * *



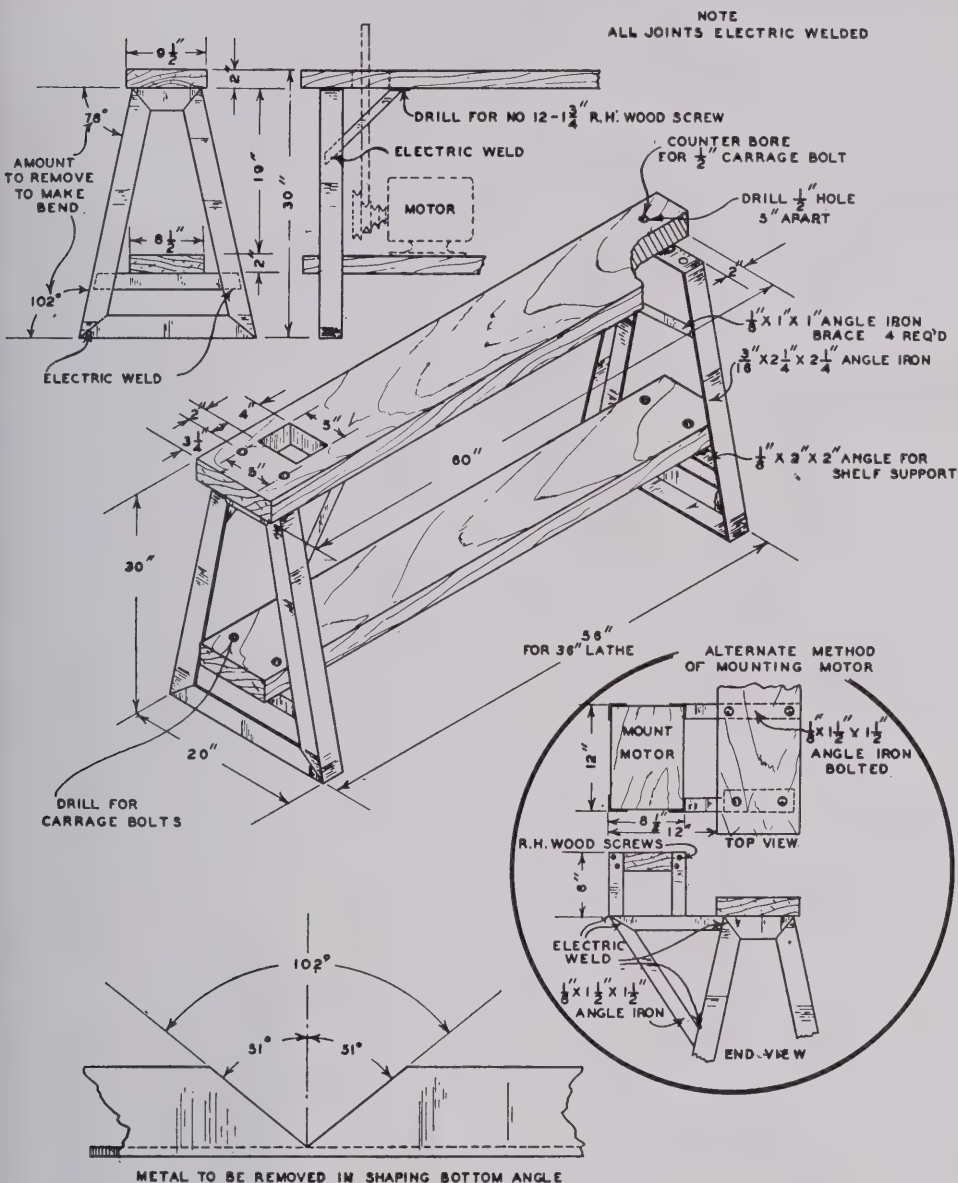
3. Another type of wood lathe bench built entirely of wood. Note the stool and arched apron on front of lathe bench to give comfortable leg room for operator. Another handy accessory is the desk light on flexible cable to provide good lighting for tedious work.

* * *



4. A handy wall bench for small wet grinder. A petcock through the base of the grinder bed provides handy method for daily draining of water vat.

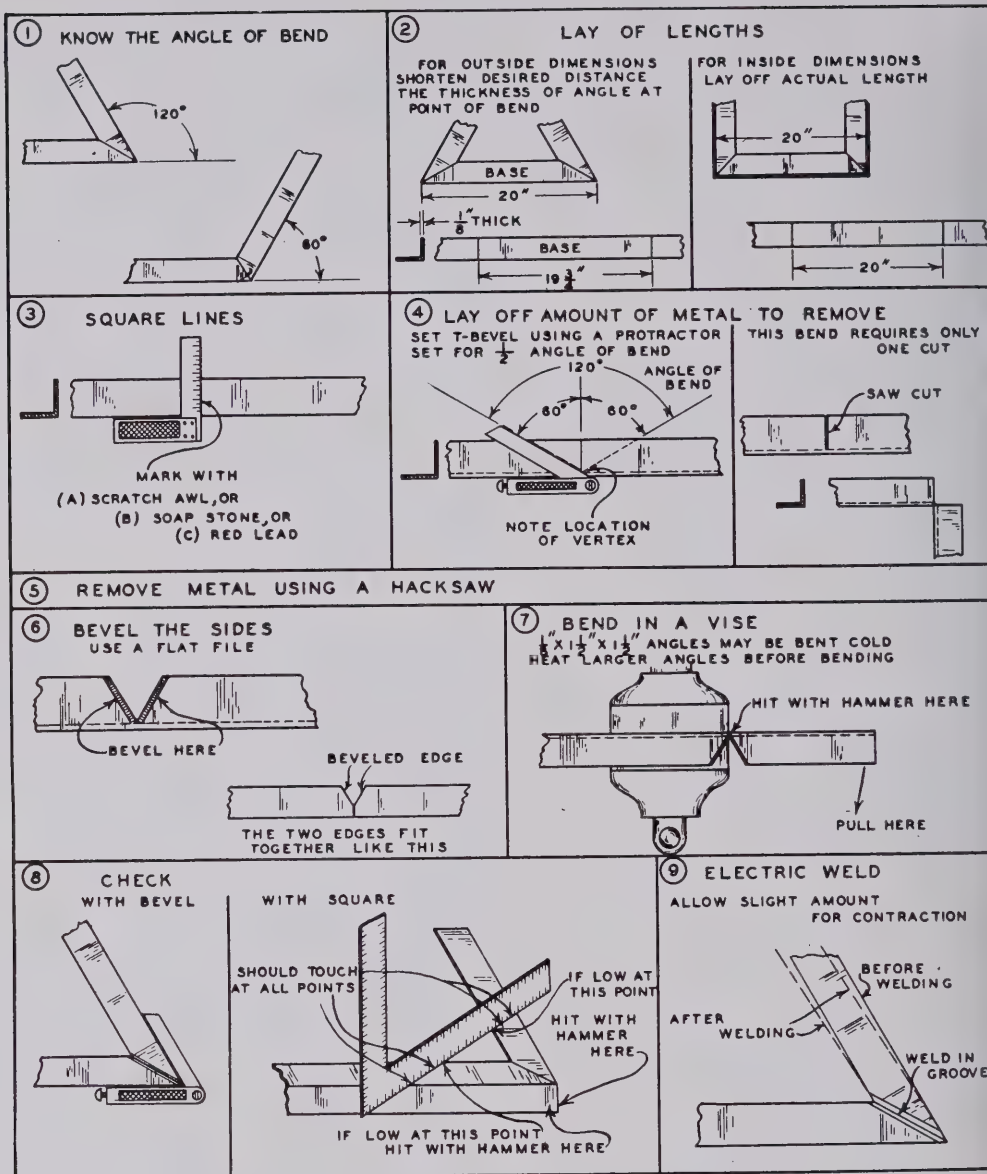
**SPECIFICATIONS FOR LATHE BENCH AS SHOWN ON
TOP OF OPPOSITE PAGE**



Too often, wood lathes are mounted on spacious work benches or tables that require considerable floor space. If a regular lathe bench is not secured from the manufacturer, one built according to the specifications above will serve just as well.

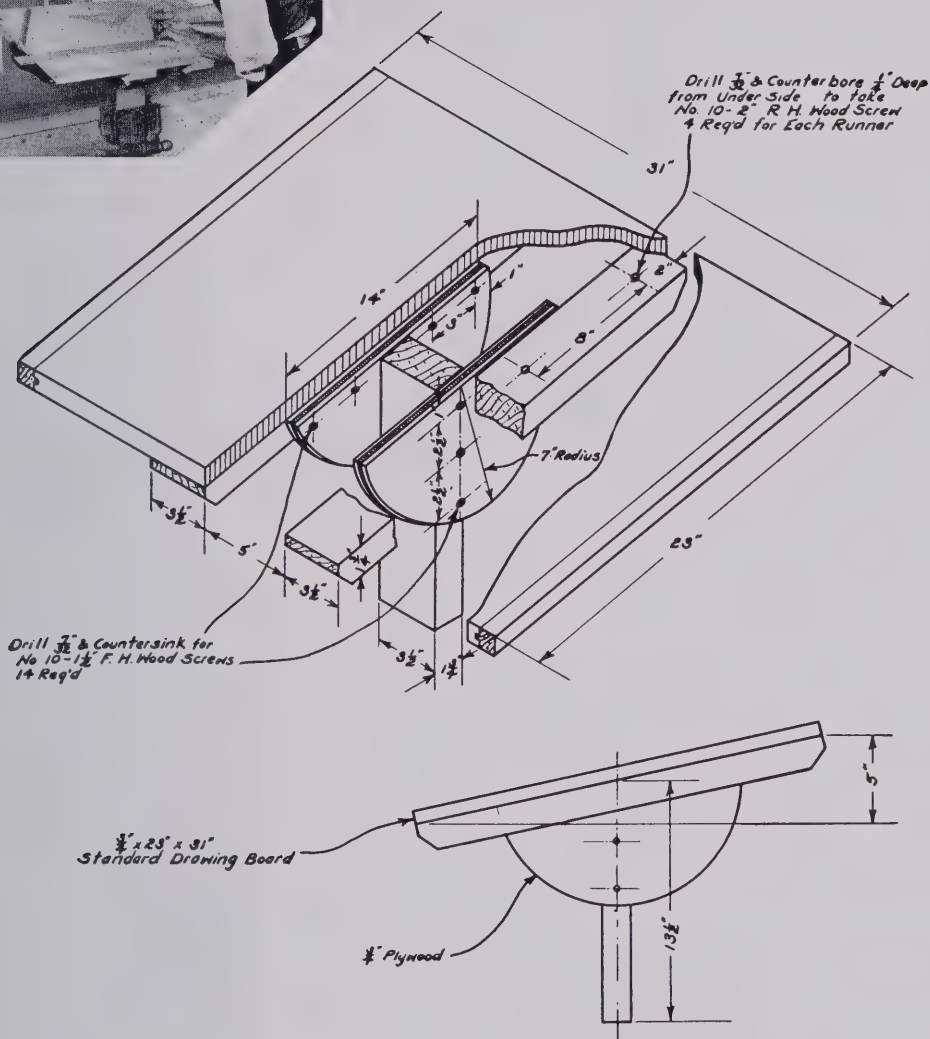
Many times there are sufficient materials available at practically no cost for building a bench according to these specifications.

SHAPING ANGLE IRON



Now that nearly all farm shops have an electric welder, scrap angle iron can be put to very practical use for general construction and repair work in farm shops and on the farm. The above layouts suggest definite methods for cutting and shaping angle iron joints for the electric weld.

A PORTABLE DRAWING TABLE



The tilted drawing table constructed according to the specifications above serves a handy purpose in the school or farm shop. It may be clamped in any ordinary vise when in use. Two or three of these are handy in the school shop. Hang on the wall or set aside in a special place provided for it when not in use.

POWER TOOLS

Power tools have become a regular part of the shop equipment in the rural schools of the State. They are used in the regular classes of vocational agriculture, and especially in the National defense classes now operated under the supervision of the teachers of agriculture.

This is a machine age. Agriculture is fast becoming mechanized. The farm shop program is therefore shifting from a period of handicraft work to activities requiring power tools. They save time and enable the student to work with increased accuracy and efficiency.

It is suggested that these power tool units be purchased and installed in the order listed below. The sizes as listed are minimum for the rural school shop. As a policy it is better to get one or two units of adequate size at a time than to sacrifice the size for a larger number of units. Units smaller than the following have not proven satisfactory for daily use in the schools.

Power grinder with 8" or 10" wheels, 1 H.P.

Drill press, floor model, $\frac{1}{2}$ " chuck.

Bench saw, 12" with 2 H.P. motor.

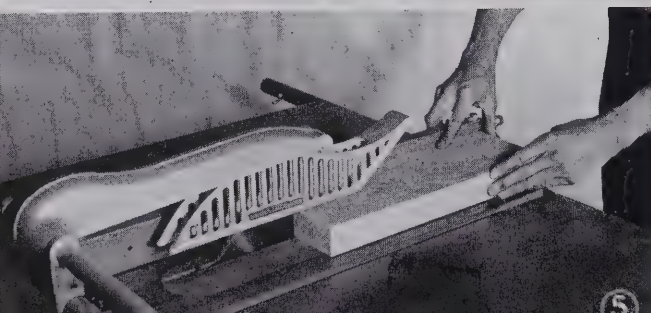
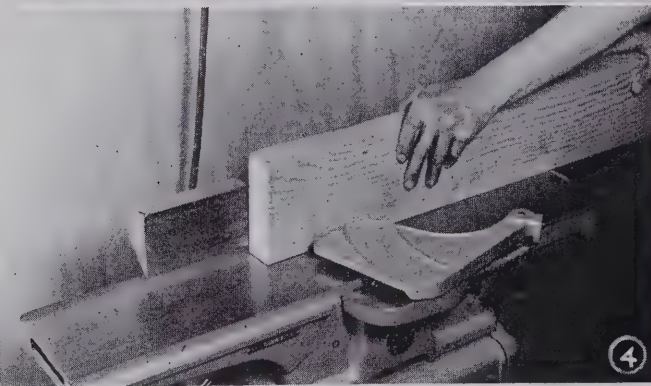
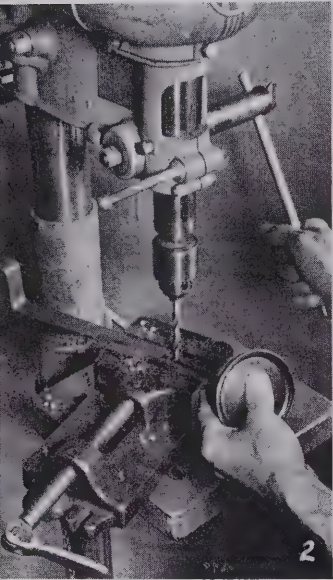
Jointer 6" to 8".

Electric welder, 200 amperes.

Band saw 16".

A power hack saw, capacity 6" to 8".

If other units are to be added to the above list, the sizes should be in the same general ratio.



SUGGESTED ACCESSORIES FOR POWER TOOLS

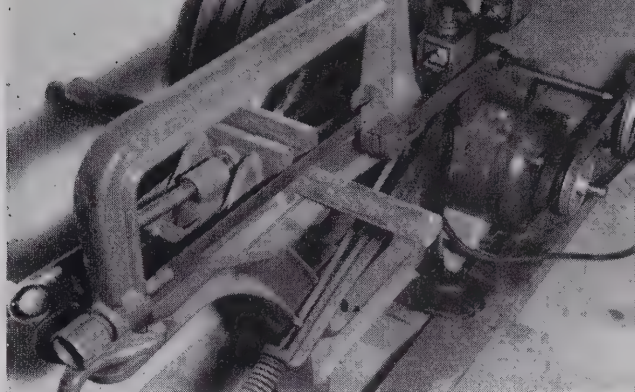
Accessories for power tools should be mounted in an accessory cabinet conveniently located. A few of the accessories cannot be placed in the cabinet and should be attached to the tool or be located near by. The suggested accessories listed below are given in the approximate order of importance.

General

Sufficient wrenches in each accessory cabinet to make all necessary adjustments.

Utility and Tool Grinders, and Polishing Heads

Safety shields	Fine wire brush
Two machinists goggles	Adjustable tool rest for plane iron and chisels
Grinding wheel	Tool sharpening gauge
100-grit grinding wheel	Four buffing cloth wheels
60-grit grinding wheel	Polishing compound
24-grit grinding wheel	Coarse wire brush
3½" x 5½" sickle grinding wheel	



Circular Saw

Combination rip and crosscut blade	Dado head with table insert
Crosscut blade	Miter gauge clamp attachment
Rip blade	Tenoning attachment
Miter blade	Tapering jig, homemade
Safety stick	Moulding head with one set of moulding cutters

Drill Press

High speed twist drills, 1/16"	Mortising attachment with 1/4",
to 1/2" by 64ths	3/8", and 1/2" bits and chisels
Machine spur bits 1/8" to 1"	Table of tap and drill sizes
by 8ths	Speed table
Drill press vise	
Oiler with cutting oil	
Two 5" C-clamps	
Chuck key attached to drill	
by light chain	

Welder

Leather gauntlet gloves	Scratch brush
Welding helmet	Chipping hammer
Hand shield	Two 6" C-clamps

Jointer

Extra set of knives	Plywood auxiliary high fence,
Push stick	3/4" x 12"
	Two 5" C-clamps

Power Hack Saw

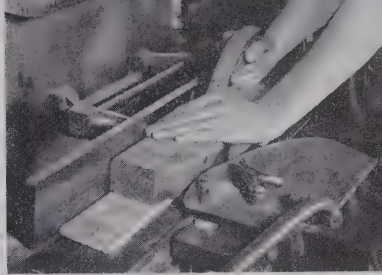
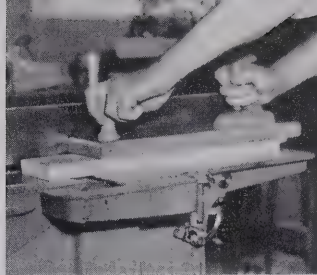
Two 10-tooth high speed blades	Two 18-tooth high speed blades
Two 14-tooth high speed blades	

Band Saw

Saw blade, 3/16"	Saw blade, 1/2"
Saw blade, 1/4"	Saw blade, 3/4"
Saw blade, 5/8"	Chart of minimum cutting circles

BE CAREFUL

It takes years to grow a full size finger, an eye, or a hand, but it takes only an instant to lose one in the school shop by accident.



Suggestions to the shop teacher:

1. Perfect the arrangement of the shop equipment and maintain good housekeeping.
2. Give adequate instruction on how to safely operate power tools before allowing any student to operate them.
3. Allow students to use a machine or machines only by permission.
4. Secure a written statement from the parents that they are willing for their boy to operate the power tools. Keep these statements on file. This will emphasize the importance of more care on the part of the student, but this will not relieve the teacher of his responsibility.
5. Conduct tests for each student. Don't allow any student to operate a machine until he has passed a satisfactory test.
6. Prepare a set of posters on cautions to observe when operating any or all the above tools. Post near the tool for study by the operator. On front of the accessory cabinet is a good location.
7. Have a safety committee in each shop class to check and correct improper procedures attempted by their classmates at any and all times. Make specific assignments to all students to maintain good housekeeping. Rotate these assignments from month to month so all students may benefit from a full cross-section of housekeeping practices desirable in the well kept shop.

Turn to page 57 for a suggested student personnel organization.

References:

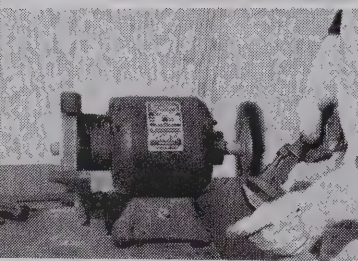
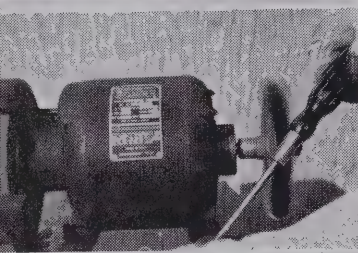
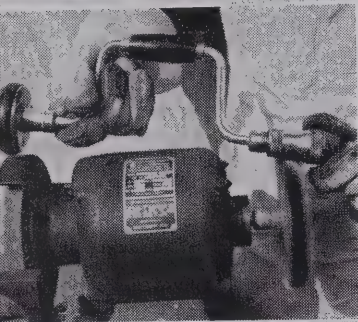
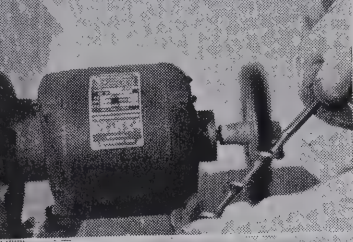
Smith, J. Warren, *Safety Education for Shop Teachers in North Carolina Schools*, Division of Teacher Education, North Carolina State College, Raleigh, N. C. Free.

Safety Training for Vocational Schools and School Shops, The National Safety Council, Chicago, Ill. 50¢ a copy.

Training for Safety, Bulletin No. 279, The State Board of Control for Vocational Education, Lansing, Michigan.

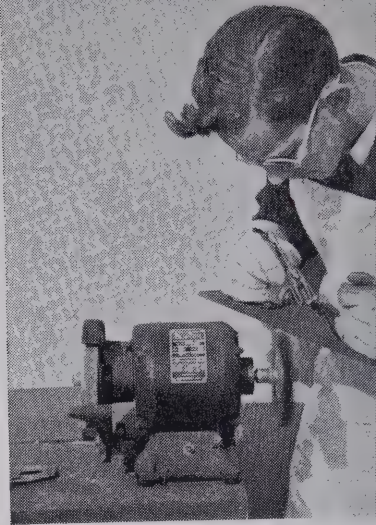
Protect Your Hands





Polish Up Your Shop Tools

Don't Forget
Your Goggles,
Heavy Gloves,
and Apron



Despite the best of care, rust spots eventually form on shop tools. Knurled surfaces and crevices become rust coated with constant student use. Many shop rooms are located in basements where moisture is in excess. Tools become rust coated quickly under such conditions unless they are given special daily care.

Even with the best of care tools should be cleaned and polished up occasionally. Students should be taught to give every care practical to both school and home shop equipment.

One of the quickest and most practical methods of removing rust and polishing up tools is illustrated on this page. These are only a few of the many that may be quickly cleaned and polished by the rotary wire brush.

Where electric current is not available, scrub the tools briskly with a coarse rag coated with ground pumice and oil. Rub all tools with an oily rag after cleaning and polishing. Keep the tools oil coated at all times when not in use.

In cleaning an old, dry paint brush, soak for about an hour in varnish remover, wash in turpentine, gasoline, or kerosene, and brush with fine rotary wire brush or hand wire brush, rewash, dry with cloth and wrap in paper so the bristles will not curl.

Practically all painters who use brushes continuously, place them in a metal container filled with water up to the metal band of the brush. The brush should be suspended by some handle support above the container to keep pressure off the bristles. If the brush is not to be used daily, linseed oil should be used in place of water. Water evaporates leaving the bristles dry after a short time. The best care of the paint brush is to clean thoroughly immediately after use and wrap in a piece of tarpaper or other heavy paper and store flat in a box or suspend by the handle.

IDEAS

Racking lumber in the school shop is always a problem for the shop teacher. The illustrations on this page offer a few suggestions on how this problem may be solved.

* * *

1. A 10' x 20' shed built to the main shop provides adequate space for storing a general stock of lumber and other stock for the shop.

* * *

2. A large lumber rack constructed in the attic. Often a ventilated attic over the shop or an adjacent classroom can be used to an advantage for lumber storage.

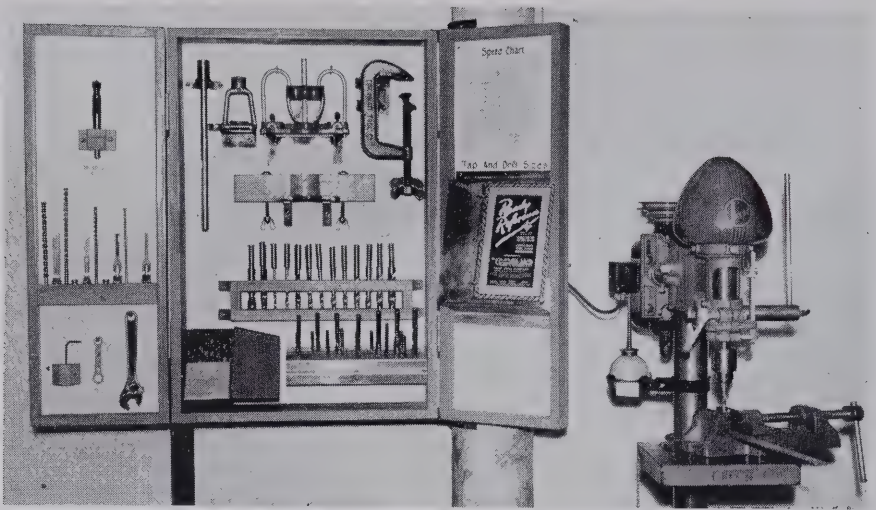
* * *

3. Bringing lumber down from the attic over the shop.

* * *

4. A vertical rack just outside of the main shop room. The entrance to the main shop is only about three feet from the end of this rack.





Accessories for power tools should be racked conveniently in a cabinet within easy reach of the operator, if possible. The above picture shows a good arrangement for drill press accessories. All the tools and accessories necessary for both metal and woodworking operations usually done with the drill press are conveniently racked in this cabinet. See pages 49 and 50 for suggested list of accessories for power tools.

Small corner cabinets are convenient for classifying and storing general supplies. The picture to the right shows a supply cabinet for storing sand paper, emery cloth, steel wool, sanding blocks and dust rags. Note the separate compartments for the different grades of sand paper and other articles. Other general supplies should have some definite and convenient storage space in the shop.



IDEAS

1. A portable table stand for the paint sprayer. It is set on casters to facilitate movement from place to place in the shop.

* * *

2. A discarded truck wheel and a rear-axle housing welded together to form an excellent stand for the tool grinder. A board $1\frac{3}{4}$ " x $9\frac{1}{2}$ " x 12" fastened to the top of the pedestal by heavy wood screws serves as the base for the grinder.

* * *

3. A very practical forge unit built of a tractor bull wheel, supported with legs of two-inch pipe. The wheel is filled in around the tuyere iron with brick and concrete. A hole is cut through the rim of the bull wheel for running the blower pipe to the tuyere iron.

* * *

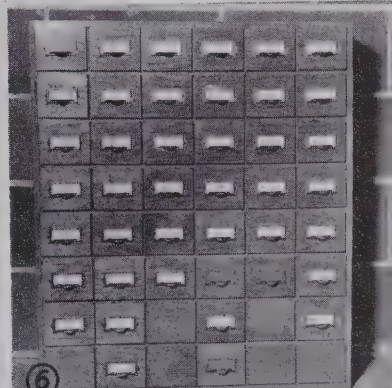
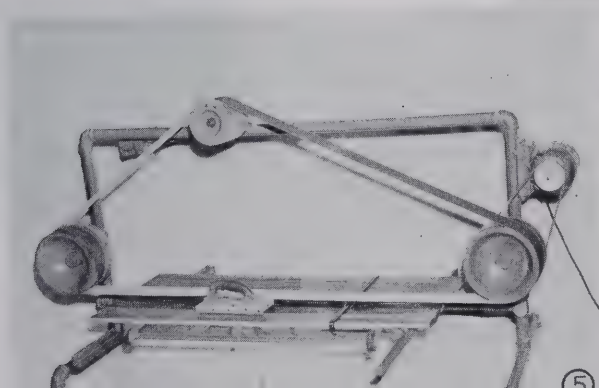
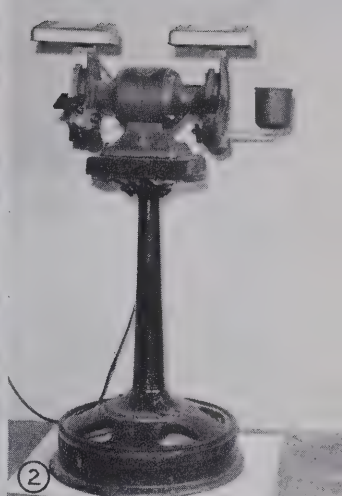
4. A good type of shop door and entrance on ground level for the vocational agriculture shop.

* * *

5. A handy portable belt sander that can be built in the shop. Specifications will be sent upon request. Designed and built by L. K. Singley, Hendersonville.

* * *

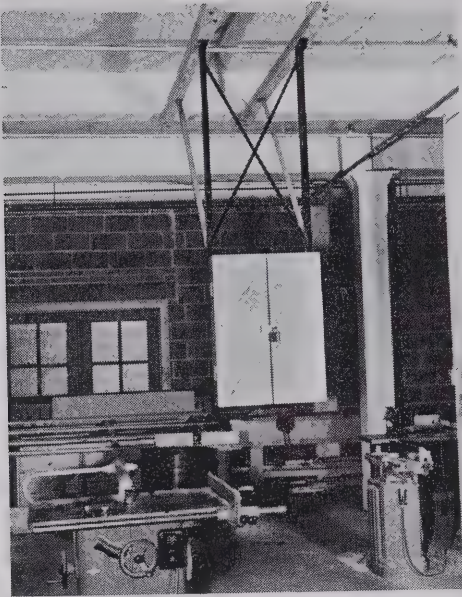
6. A cabinet for nails and screws with 48 containers 4 " x 6 " x $2\frac{1}{2}$ " deep.



IDEAS

A cabinet for bench saw and jointer accessories swung from the ceiling by angle iron as shown will save many unnecessary steps. The bottom of the cabinet should be about 18" to 20" above the table top of the bench saw. Locate the cabinet as shown in the picture.

Construct a cabinet 8" x 22" x 32" in size and similar to the drill press cabinet shown on page 23. Suggested accessories and tools to be racked in this cabinet are listed on page 49.



A small open case for racking paints, stains, glues, and a limited amount of cleaning and polishing materials is convenient in the paint room if such a room is available. Fruit jars, carefully labelled, are practical containers for liquids, pumice stone, and similar supplies.



STUDENT ORGANIZATION FOR CARE OF THE SHOP AND SHOP EQUIPMENT

This is a suggested form for use in assigning student responsibilities to care for the shop and the shop equipment. The form is arranged to provide each student with the same responsibilities during a period of seven months. Use a separate form for each shop class.

Names of Student Committees		COMMITTEE ASSIGNMENTS BY MONTHS						
	Month	Month	Month	Month	Month	Month	Month	Month
	Grinder, drill press and accessory cabinets	Bench saw, jointer, and accessory cabinets	Workbenches, tool cabinets in main shop room	Workbenches, tool cabinets in main shop room	Tool room scrap pile and tools	Lumber rack, scrap pile, and floors	Forge unit and equipment	Miscellaneous
	Bench saw, jointer and accessory cabinets	Workbenches, tool cabinets in main shop room	Tool room	Tool room	Lumber rack, scrap pile and floors	Forge unit and equipment	Miscellaneous	Grinder, drill press and accessory cabinets
	Workbenches, tool cabinets in main shop room	Tool room and tools	Lumber rack, scrap pile and floors	Lumber rack, scrap pile and floors	Forge unit and equipment	Miscellaneous	Grinder, drill press and accessory cabinets	Bench saw, jointer and accessory cabinets
	Tool room and tools	Lumber rack, scrap pile and floors	Forge unit and equipment	Miscellaneous	Grinder, drill press and accessory cabinets	Workbenches, tool cabinets in main shop room	Tool room	Workbenches, tool cabinets in main shop room
	Lumber rack, scrap pile and floors	Forge unit and equipment	Miscellaneous	Grinder, drill press and accessory cabinets	Bench saw, jointer and accessory cabinets	Workbenches, tool cabinets in main shop room	Lumber rack, scrap pile and floors	Forge unit and equipment
	Forge unit and equipment	Miscellaneous	Grinder, drill press and accessory cabinets	Bench saw, jointer and accessory cabinets	Workbenches, tool cabinets in main shop room	Lumber rack, scrap pile and floors	Forge unit and equipment	Miscellaneous
	Miscellaneous	Grinder, drill press and accessory cabinets	Bench saw, jointer and accessory cabinets	Workbenches, tool cabinets in main shop room	Lumber rack, scrap pile and floors	Forge unit and equipment	Miscellaneous	Grinder, drill press and accessory cabinets
	Grinder, drill press and accessory cabinets	Bench saw, jointer and accessory cabinets	Workbenches, tool cabinets in main shop room	Tool room	Lumber rack, scrap pile and floors	Forge unit and equipment	Miscellaneous	Bench saw, jointer and accessory cabinets

Make report of any broken or misused or misplaced part or other unfavorable conditions found before leaving shop.

Teacher of Vocational Agriculture.

TOOLS FOR VOCATIONAL AGRICULTURE SHOPS

(Specifications according to State contract list "*Tools—Vocational Training and General Shop*," No. 2205, Division of Purchase and Contract, Raleigh, North Carolina, effective June 1, 1942 to June 1, 1943.

Orders should be placed by county superintendent of schools as purchasing agent.

The farm shop program as now conducted in the rural schools requires both hand and power tools in order to meet the demands for all types of shop classes. The suggested items in this list have been found necessary in order to provide adequately for minimum enrollments of students in school, out-of-school, part-time, and the adult groups.

HAND TOOLS

Woodworking and Miscellaneous Tools

I. Abrasives

No.	Description of Tools
1	*Water grinder, Duro, with motor and 10" x 1½" stone, No. C 3043
or	
1	Grindstone, mounted ball bearing, R. W., No. 400
1	Heavy duty hand tool grinder with 7" x 1½" grinding wheels, gear ratio 16 to 1, Keystone
1	Grinding wheel dresser with two sets of cutters, Desmond Stephen No. 1
3	Oil stones, Carborundum combination oil stones 8" x 2", No. 108 Pumice stone, ground Italian, 10 lbs. Sand paper, 9" x 11", highest quality, 6 quire No. 0 6 quire No. ½ 6 quire No. 2 Emery cloth, 9" x 11", highest quality, 1 quire No. ½

II. Braces and Bits

1	Sets of auger and bits, sizes ¼, 5/16, ¾, 7/16, ½, 9/16, 5/8, 11/16, ¾, 13/16, 7/8, 15/16, 1", Bluwin, No. 162T
1	Expansive bit, 7/8" to 3", Lockhead, No. 2
1	Bit extension 15", Irwin, No. 9
1	Set gimlet bits, dozen assorted for bit brace
2	Screw driver bits, ¼", Stanley, No. 26
1	Screw driver bit, 5/16", Stanley, No. 26
1	Screw driver bit, ¾", Stanley, No. 26
1	Screw driver bit, ½", Stanley, No. 26
3	Countersink, rosehead, ¾", Stanley, No. 139
3	Ratchet braces, 10" swing, Stanley, No. 919
1	Non-ratchet brace, 10" swing, Stanley, No. 916
1	Soil auger, 2" x 40" overall, Greenlee, No. 95

III. Chisels

2	Sets of wood chisels, ¼", ½", ¾", 1", and 1½", Stanley, No. 20 firmer.
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IV. Clamps

<i>No.</i>	<i>Description of Tools</i>
4	Bar clamps, 5', Hargrave, No. 640
4	Hand screws, 10", Hargrave, No. 710
2	C-clamps 4", Hargrave, No. 540
2	C-clamps 5", Hargrave, No. 540
2	C-clamps 7", Hargrave, No. 540
2	C-clamps 10", Hargrave, No. 540

V. Drills

1	Hand drill, $\frac{3}{8}$ " chuck, Stanley, No. 626
1	Set of twist drills, 1/16", 3/32", $\frac{1}{8}$ ", 5/32", 3/16" and $\frac{1}{4}$ " straight round shank, carbon, Cleveland

VI. Files

2	Half round cabinet files, 8", Nicholson
2	Flat wood files, 10", Nicholson
6	Extra slim taper saw files, 5½", Nicholson
6	Auger bit files, Nicholson
1	Disston file card-brush, 5" x 1½", Disston, No. 2
6	File handles, interchangeable screw-on type

VII. Hammers

2	Adze eye bell face nail hammers, 13 oz., Stanley, No. 52
6	Adze eye bell face nail hammers, 16 oz., Stanley, No. 51½"
2	Ripping nail hammers, 16 oz., Stanley, No. 51½ A

VIII. Hatchets

2	Half hatchets, 3⅜", Stanley, No. 21
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IX. Measuring Devices and Squares

6	Try squares, 8" blade, Stanley, No. 12
3	Combination squares, 12", Stanley, No. 21
3	Sliding T bevels, 8", Stanley, No. 18
4	Framing squares, Stanley, No. R-100
1	Steel tape 50', Trustworthy, No. 543
2	Dividers, 8" wing, Pexto, No. 165
3	Marking gauges, Stanley, No. 62

X. Planes and Plane Bits

4	Jack planes, 14" x 2", Stanley, No. 5
2	Block planes, all steel, 6" x 1⅝", Stanley, No 118
4	Plane bits for Jack plane, Stanley, No. 5
2	Plane bits for block plane, Stanley, No. 118
2	Spoke shaves, malleable, Stanley, No. 151M
1	Cabinet scraper, Stanley, No. 80 M

XI. Saws

1	Rip saw, 7 pts., 26", Atkins, No. 53
3	Crosscut saws, 10 pts., 26", Atkins, No. 53
3	Crosscut saws, 8 pts., 26", Atkins, No. 53
3	Coping saws, Atkins, No. 50
3	Doz. extra blades for coping saw, Atkins, No. 50
1	Pistol grip saw set, Atkins, No. 42

XII. Screw Drivers

<i>No.</i>	<i>Description of Tools</i>
2	Screw drivers, 3", Stanley, No. 20
2	Screw drivers, 5", Stanley, No. 20
2	Screw drivers, 8", Stanley, No. 20
2	Screw drivers, 10", Stanley, No. 20
1	Screw driver set for "Phillips" screws, Stanley, No. 2700 AD

XIII. Vises

4	Woodworking bench vise, 4" x 7" jaws with dog, Columbia, No. 5 CDS
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XIV. Miscellaneous

1	Wrecking bar $\frac{3}{4}$ " x 30", Stanley, No. 130
3	Putty knife, stiff blade, $1\frac{1}{8}$ " x $3\frac{3}{4}$ ", No. 20
2	Cutters, glass, Red Devil
2	Levels, 26", Stanley, No. 3
1	Nail set, square head, 1 doz. assorted, Stanley, No. 11 $\frac{3}{4}$
2	Oilers (oil cans), Eagle, No. 28
2	Oilers (oil cans), Eagle, No. 15
2	Pliers, 8", Crescent, No. 1000
3	Slip joint pliers, 6", Crescent, No. H26
1	Set steel stamp letters and figures $\frac{1}{4}$ " machine made
2	Draw knives, 8", Greenlee, No. 600
1	Trowel, 10", Marshalltown, No. 19W
1	Farm level, Bostroms, No. 2
6	Paint brushes, 1", Osborn, No. 550 or equivalent
6	Paint brushes, 2", Osborn, No. 550 or equivalent
6	Paint brushes, 2", Osborn, No. 444 or equivalent
3	Paint brushes, 3", Osborn, No. 434 or equivalent
2	Glue brushes, 1" diameter

APPROXIMATE COST OF HAND WOODWORKING TOOLS \$250.00

BLACKSMITH AND METAL WORKING TOOLS

1	Anvil, steel face, 100 to 200 lbs.
1	Hardie (size to fit anvil), Stanley, No. 1310
1	Tuyere iron 5" x $8\frac{3}{4}$ " x $10\frac{1}{2}$ ", Champion, No. 400
1	Forge blower, Champion, No. 65
2	Pairs of goggles, grinding, Columbia, No. 481
2	Hammer, blacksmith's hand, drop forge steel, 32 oz., Stanley, No. 401
2	Hammer, machinist, ball pein, 12 oz., Stanley, No. 309 B
2	Tongs, straight lip, 20", Stanley, No. 10
2	Tongs, curve lip, 20", Stanley, No. 12

<i>No.</i>	<i>Description of Tools</i>
1	Vise, machinist stationary base, 4½" jaw, American Red Seal, No. 53
1	Chisel, blacksmith handled, hot cutter, 1¼", Stanley, No. 1300
1	Chisel, blacksmith handled, cold cutter, 1¼", Stanley, No. 1290
1	Chisel, hand chipping, ⅝", Hargrave, No. 200
1	Chisel, hand chipping, ¾", Hargrave, No. 200
1	Chisel, hand chipping, 1", Hargrave, No. 200
1	Chain drill, 3" jaw, straight round shank, Yankee, No. 1500
1	Monkey wrench, knife handle, 8", Trimo
1	Monkey wrench, knife handle, 12", Trimo
1	Set wrenches, open end, ⅝" to 1", Crescent
3	Wrenches, adj. open end, Crescent, Nos. A108, A110, and A112
2	Punches, octagon tool steel, ¼" point, 10" length, Hargrave, No. 2866
2	Punches, ⅛", Hargrave, No. 263
2	Punches, 3/16", Hargrave, No. 263
1	Center punch, ½", Hargrave, No. H284
1	Drift punch, ¼", 10", Hargrave, No. 630
1	Screw plate, NC., ¼" to ¾" by 16ths, Greenfield, No. 3110
2	One foot squares, Stanley, No. 10
2	Hack saws, 12", pistol grip, Atkins, No. 111
12	Hack saw blades, 12", Atkins, AAA
2	Soldering coppers complete with handles, No. 2
3	Pounds solder, Kester acid and rosin core, No. 1
1	Tinner's snips, 8", Crescent, No. S48
1	Circular cutting snips, 3", Crescent, No. T412
1	Blow torch, Clayton and Lambert, No. 600A
2	Mill files, bastard, 10", Nicholson
2	Flat files, bastard, 10", Nicholson
2	Flat files, bastard, 12", Nicholson
1	Round file, 2d. cut, 10", Nicholson
1	Half round file, 2d. cut for metal, 10", Nicholson
8	File handles, screw-on interchangeable type
1	Center reamer, high speed, ⅝"
1	Post drill, equipped with three jaw chunk, capacity holes up to 1", Buffalo or Champion
1	Set of jobbers straight shank high speed steel drills, 1/16" to ½" by 8ths, Whitman and Barnes
1	Set round shank carbon steel blacksmith drills ⅝", ¾", ⅞", and 1"
1	Slip joint pliers, 8", Crescent, No. H28
1	Bolt cutters, 18", Porter, No. 0

APPROXIMATE COST OF METAL WORKING TOOLS

\$175.00



TOOLS FOR PLUMBING

No.	Description of Tools
1	Pipe cutter, $\frac{1}{2}$ " to 2", Armstrong, 2B
1	Pipe stock and dies with ring bushings for $\frac{1}{2}$ ", $\frac{3}{4}$ ", 1", 1 $\frac{1}{4}$ ", Armstrong, No. 2 $\frac{1}{2}$
1	Pipe reamer, straight fluted, $\frac{1}{4}$ " to 1 $\frac{1}{4}$ ", Armstrong, No. K1
1	Pipe vise, hinged, $\frac{1}{8}$ " to 2", American, No. 2
2	Pipe wrenches, steel handled, 14", Trimo
1	Pipe wrench, steel handled, 18", Trimo

APPROXIMATE COST OF PLUMBING TOOLS \$25.00

TOTAL APPROXIMATE COST

WOODWORKING AND MISCELLANEOUS TOOLS.....	\$250.00
BLACKSMITH AND METAL WORKING TOOLS.....	\$175.00
TOOLS FOR PLUMBING.....	\$ 25.00
GRAND TOTAL, HAND TOOLS.....	\$450.00

POWER TOOLS

Power grinder with 8" or 10" wheels, 1 H.P.
 Drill press, floor model, $\frac{1}{2}$ " chuck
 Bench saw, 12' with 2 H.P. motor
 Jointer 6" to 8"
 Electric welder, 200 amperes
 Band saw 16"
 A power hack saw, capacity 6" to 8"

Write State Division of Purchase and Contract for prices on power tools. The necessary accessories should be included with the purchase of each machine or tool. See page 49 for general suggested list.

A FEW SELECTED REFERENCES

BOOKS

ROEHL, L. M., *Farmer's Shop Book*, The Bruce Publishing Company, Milwaukee, Wisconsin, 1939. Latest edition. Retail price, \$2.80. 422 pages.

This book is on the State's adopted list. The latest edition is completely revised and enlarged and is highly illustrated. Every teacher of agriculture should have several copies of this book for his farm shop classes.

JONES, MACK M., *Farm Shop Practice*, McGraw-Hill Book Company, New York City, 1939. Retail price, \$2.75. 315 pages with 360 illustrations.

This new text deals simply yet thoroughly with tools and basic tool processes used in the farm shop. It is designed to supplement discussion and demonstration and for study and review. Every farm shop teacher should have one or more copies.

DOUGLASS AND ROBERTS, *Instruction and Information Units for Hand Woodworking*, The McCormick-Mathers Company, Wichita, Kansas, 1932. Retail price, \$0.80. 104 pages.

This booklet is organized with "companion" units—information about the tool or methods to be used and how to do the job. For example, in the set-up on the wood chisel the first unit gives information about the types of wood chisels and the second unit, or companion unit, gives directions and methods on how to use a wood chisel. This is a good reference for the beginner.

FRYKLUND AND LABERGE, *General Shop Woodworking*, McKnight and McKnight Company, Bloomington, Illinois, 1936. Retail price, cardboard cover, \$0.72; cloth bound, \$0.96. 128 pages.

This work book was written primarily for use in junior high schools. It is organized with seventy-one units classified under the general headings: (1) What you should be able to do and (2) What you should know. "To lay out and cut stock," "To sharpen and use a hand scraper," are examples of units under the first heading. "To read a working drawing," "season of lumber," are examples of units under the second heading. This is a good reference for the beginner.

COOK, SCRANTON, AND MCCOLLY, *Farm Mechanics, Text and Handbook*, Interstate Printing and Publishing Company, Danville, Illinois, 1935. Retail price, \$2.50. 450 pages.

Emphasis is given in this text on the selection and purchasing of suitable equipment and supplies used in woodworking, painting, finishing, glazing, concrete work, sheet metal work, farm forge work, etc. "Classifying, selecting, and caring for lumber," and "The classifying, care and use of woodworking tools," are headings of two chapters indicative of the nature of the content.

DICKINSON, *Job Operations in Farm Mechanics*, The Interstate Printing and Publishing Company, Danville, Illinois, 1936. Retail price, \$1.25. 165 pages.

This guide for farm shop work was originally prepared by teachers of agriculture of Missouri. It is organized on the job basis. The materials, tools, and procedure are listed with questions and references for study under each job. It is a good reference for use of students.

JONES, MACK M., *Manual of Farm Shop Work*, McGraw-Hill Book Company, New York City, 1941. Retail price, \$0.75. 81 pages.

This manual consists of plans for small devices and appliances that may be made at home or in the school shop. The devices were included on the basis of the tool processes involved, the usefulness of the devices and the small amount of materials necessary to do the job. It includes eighteen devices which may be made from wood, ten from cold metal and fifteen from hot metal.

GRIFFITH & COX, *Woodwork for Secondary Schools*, The Manual Arts Press, Peoria, Illinois. Retail price, \$2.00. Pages 76 to 152 of this book are devoted to the operation and use of woodworking machinery. It is a good reference for students and teachers whose shops are equipped with power tools.

SMITH, ROBERT E., *Information and Operation Units in Machine Woodworking*, The McCormick-Mathers Publishing Company, Wichita, Kansas. Retail price, \$0.80. 160 pages.

An excellent book for the beginner. It has a large number of very fine illustrations.

COGIN, ARMSTRONG AND GILES, *A Manual on Sharpening Hand Woodworking Tools*, Interstate Printing and Publishing Company, Danville, Illinois, 1939. Retail price, \$0.29. 50 pages.

A highly illustrated handbook for the individual student's use with a total of 176 close-up drawings on how to sharpen 13 different hand working tools, including hand-saws, timber saws, chisels, plane bits, etc. All drawings are associated with text directions, giving full information on just how to do the job. It is especially adapted for the beginner.

MORRISON, IVAN G., *Repairing Farm Machinery*, The Interstate Printers and Publishers, Danville, Illinois, 1940. Retail price, \$1.80. 182 pages well illustrated.

This book gives specific instructions on how to repair mowers, grain binders, walking plows, wheeled plows, disk harrows, spike tooth harrows, spring tooth harrows, cultivators, corn planters, grain drills, side delivery rakes, corn binders, and the painting of farm machinery.

SELVIDGE, R. W., AND ALLTON, J. M., *Blacksmithing*, The Manual Arts Press, Peoria, Illinois. Retail price, \$1.20. 160 pages.

Forty-eight instruction units, seventeen information topics, and seven standard tables are given in this text.

SMITH, ROBERT E., *Units in Forging and Welding*, The McCormick-Mathers Company, Wichita, Kansas, 1941. Retail price, \$0.48. 60 pages, 8½" x 11", with excellent illustrations.

A good book for the beginner.

BULLETINS

ROSS, W. A., BEARD, W. P., DEISS, JAY, AND PRICKETT, LEE C., *Building Electrical Equipment for the Farm*, published by the Federal Security Agency, United States Office of Education, Washington, D. C., 1940. For sale by the Superintendent of Documents, Washington, D. C. Price, \$0.20. 100 pages.

This bulletin contains organized teaching material on how to build such practical electric appliances and equipment as the pig brooder, chick brooder, hot bed, poultry water warmer, stock tank heater, and a portable motor.

Farm Machinery Charts, mimeographed bulletin 8½" x 11", Nos. 1 to 15, on the repair of mowing machines, published by the Department of Agricultural Engineering, University of Missouri, Columbia, Missouri. Price, \$0.05.

Farm Machinery Charts, mimeographed bulletin 8½" x 11", Nos. 16 to 26, on the repair and adjustment of plows, published by the Department of Agricultural Engineering, University of Missouri, Columbia, Missouri. Price \$0.05.

NOTE: For a more complete set of references, teachers of agriculture in North Carolina should write for a copy of *Supplies and Equipment for Departments of Vocational Agriculture*, suggested helps, number 32, October, 1941.

SMITH, J. WARREN, *Safety Education for Shop Teachers in North Carolina Schools*, Bulletin 2, Industrial Education Series, Division of Teacher Training, North Carolina State College, Raleigh, North Carolina.

This bulletin is free to teachers of agriculture in the State. It contains, among other things, specific safety rules for operating power tools, and for the use of hand tools. Shop teachers and their students should give it special study.

REFERENCES ON POWER TOOLS

Manufacturers of the smaller power tools publish a number of very practical booklets on how to operate and care for their tools. Write the manufacturers of the machines used in your shop for their booklets. The prices for these booklets usually range from 25 cents to 50 cents a copy.

MAGAZINES

There is no one publication, monthly or otherwise, especially adapted for the use of teachers of farm shop work. The few listed below are very popular. Almost every issue has a number of practical suggestions for the teacher of agriculture and his students:

The Delta, Delta Mfg. Co., 600-634 E. Vienna Ave., Milwaukee, Wisconsin. Six copies a year. \$0.50.

Popular Science, Popular Science Publishing Company, 353 Fourth Ave., New York City. Twelve copies a year. \$1.50.

Agricultural Education, Meredith Publishing Co., Des Moines, Iowa. One year, \$1.00.

Industrial Arts and Vocational Education, Bruce Publishing Co., 540 North Milwaukee Street, Milwaukee, Wisconsin. Ten copies a year, \$2.50.

